Multi-Factor Motivation Model In Software Engineering Environments

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Abstract

In software engineering environments, motivation has become an imperative tool for increasing the productivity and creativity levels of projects.

The aim of this research is to develop a validated conceptual multifactor and motivating model that represents the interaction between the organisational, occupational and interpersonal factors in software engineering environments. However, the application of well-known motivation tools cannot guarantee high motivational levels among the members of software engineering teams. Therefore, several phenomena have been monitored and empirically tested related to the daily practices in the software engineering industry.

Reviewing the literature on motivation in software engineering uncovered a list of influential factors that could motivate individuals in the workplace. These factors have been suggested as being grouped into three categories (interpersonal, occupational and organisational).

The literature review stage was followed by a preliminary study to discuss and validate these factors in greater detail by interviewing eight experts drawn from the software engineering industry. The preliminary study provided this research with an initial conceptual model that could broaden the understanding of the recent state of motivation in software engineering environments.

The initial model was validated and expanded by conducting two types of research (quantitative and qualitative) based on the type of information gleaned. Accordingly, 208 experienced software engineers and members of teams in the software development industry were involved in this research.

The results from this research revealed a statistically significant interaction between factors from different categories (interpersonal, occupational and organisational). This interaction has helped in developing an updated new model of motivation in software engineering. In addition, the application of motivation theories in software engineering could be affected by some work-related factors. These factors were found in this research to be member role, contract types, age, organisational structure and citizenship status. Thus, all these factors have been given a high consideration when designing rewards systems in software engineering.

DEDICATION

To

My Family

This dedication is to my family, in particular, to my father (Abdullah Bindrees), my mother (Nourah Alhababi), and my wife (Tahani Alnajem) for their support, encouragement, and patience.

Also to my kids (Fay, Abdullah, Nourah and Felwah)

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Chapter 1. Introduction

1.1 Research Overview

This research focuses primarily on the motivation of professionals working in the software engineering field and investigates how the interaction between organisational, occupational and interpersonal factors could affect individuals' motivation in software engineering environments. Thus, the emphasis in this thesis is on multiple-factor influences that impact individuals' motivation, technical performance and commitment in all aspects of their work in software engineering projects.

Individuals' motivation has been conceptualised in many prior studies and theories; however, the software engineering profession could have some uniqueness similar to many other professions for the following reasons:

1. Work circumstances in software engineering could have different variables that might influence the presence of this motivation.
2. Similar to other professions, software engineering could be described as a knowledge-oriented profession, which means that if a software engineer leaves his/her organisation, the knowledge possessed by that person will also go with that person (Rehman, Mahmood, & Salleh, 2011).
3. The rapid changes in technology and the global economy may change the way that professionals in software engineering environments need to be motivated and treated accordingly.

This research focuses on several critical phenomena related to the daily practices of different roles played in the software engineering industry. In order to study these phenomena, an empirical study was conducted with many experienced software engineers, as well as with members of software development teams. Hence, different methodologies and approaches were used in reaching this research's aim and objectives. This was in order to validate the hypotheses of this study by adopting both qualitative and quantitative methods. This study aims to classify several influential factors into three groups, based on the nature of the investigated factors in software engineering environments, which are suggested to be interpersonal factors, occupational factors and organisational factors.

In the research field, numerous studies into software engineering motivation have used different types of theories in order to either prove or disprove their studies' hypothesis.

In this research, a new model of motivation in software engineering is suggested and then tested empirically. This model consists of multiple correlated factors, belonging conceptually to the three principal components (interpersonal factors, occupational factors and organisational factors). Each principle part has a sub-model that should reflect the importance and the integrity of this component in the suggested motivational model. This approach could lead to a better understanding of the complexity of the motivation process in the software engineering field, and hence, the way this model's factors interact in order to achieve highly motivated personnel in the software engineering industry can be described. To do this, this research uses a combination of six motivational theories: Expectancy Theory (Vroom, 1964), McClelland's Theory of Achievement (McClelland, 1961), Equity Theory (Adams, 1963), Self-Determination-Theory for intrinsic and extrinsic motivation (R. Ryan & Deci, 2000), Goal Setting Theory (E. A. Locke, 1968) and Organisational Commitment Theory (J. P. Meyer & Allen, 1991).

Firstly, in relation to the interpersonal factors component, this research reports the influence of some selected factors on the motivational force in software engineering environments in light of McClelland's Theory of Achievement, as this theory explains how interpersonal needs and desires are important and influential in workplaces. McClelland's Theory of Achievement is tested in order to investigate how individual motivation is achieved by meeting three types of needs (achievement, control and affiliation) which are highly connected to an individual's willingness to do a particular job.

Secondly, in relation to the Occupational Factors component, three occupational factors (daily work type, member role and contract type) are tested in the light of three different motivational theories (Goal Setting, Equity Theory and Self-determination Theory SDT) in software engineering environments.

Lastly, Organisational Factors are tested by adopting two methodological approaches. The first (quantitative) approach tries to measure organisational commitment in software engineering environments, while the second (qualitative) approach investigates the influence of different organisational structures on turnover intention (withdrawal

from work), and how these structures could impede software manufacturing processes in software engineering environments. This in turn reflects negatively on the success rate of projects.

1.2 **Research Focus and Significance**

Motivation is globally acknowledged as one of the most powerful remedies for slow work and low productivity. Incorporating effective motivational strategies in software engineering environments might result in building systems as desired and requested, on time and within budget and cost. The emergence of socio-technical systems has helped researchers and professionals to develop a better understanding of how social factors can influence and interact with technology, and conversely, how technology can be influenced by people (Baxter and Sommerville, 2011). Notably, software engineers' needs and desires could be different from those of other professions, as they look for one or some of the following: variety, challenges, competent supervisors, feedback, being able to contribute, involvement in personal goals and stability (Beecham and Hall, 2007).

From the literature, the motivation could be achieved through different models, either single-factor or multifactor models. Therefore, this study tries to highlight the overlapping between three principal components (interpersonal, occupational and organisational factors) by testing the different factors in light of the six motivational theories.

1.3 **Research Scope and Limitations**

This research was carried out to develop an updated conceptual model of motivation in software engineering environments, taking into account the interaction between different types of factors in the workplace. This model was developed based on the findings of the practitioners in software engineering industry in 2015. The factors looked into were grouped into three categories (interpersonal, occupational and organisational), as they provide a multi-dimensional understanding of the dynamic attitude of the motivation in software engineering.

In addition, the limitations in this research are as follows:

1. This research is intended to be distributed worldwide to achieve a better response rate. However, the number of questions and factors might limit the number of responses considerably.
2. Saudi Arabia was chosen to be the main geographical location because of the accessibility, support and the formal permissions that were issued to this research to be conducted.
3. Females participation in this research is very limited because of two reasons:
    - The difficulties in reaching them in Saudi Arabia as they work in segregated sections, and it was difficult to meet them without extra permission and arrangements.
    - The very limited number of technical female staff in software engineering in Saudi Arabia.
    - The cultural and religious restrictions might impede meeting them to explain the aim of this research.
4. The targeted age group in this research is open. However the maximum age was 64, which could be attributed to the retirement age based on the Labour Law in Saudi Arabia, where the main sample is located.
5. This research is intended to be conducted in different cultures and countries through a web-based survey. However, this study's survey was designed based on Saudi Arabian male culture and therefore is not necessarily true or acceptable for all countries.
6. Some of items that have been designed in this research's survey were influenced by the work culture and regulations in Saudi Arabia, such as contraction issues and daily working types.

1.4 **Aim and Objectives**

The overall aim of this study was to develop an updated model to motivate professionals in software engineering environments, taking into account several factors from different sources.

In this study, the researcher aimed to achieve the following targeted knowledge (objectives):

1. To explore the influence of meeting different interpersonal desires and needs on the motivation level in software engineering environments.

2. To investigate the influence of different occupational factors on the motivation level of individuals in software engineering environments.
3. To investigate the influence of two organisational factors (organisational structure and organisational commitment) on the motivation level of individuals in software engineering environments.
4. To identify the interaction between three different types of factors (interpersonal, occupational and organisational).

1.5 Research Design and Methodology

This research adopted the pragmatic philosophical perspective, as this approach allowed qualitative and quantitative methods to be used together in one study.

Two types of studies were carried out in order to achieve this research's aims and objectives. All objectives were addressed in the quantitative approach, except the factors related to the organisational structure, as they required a qualitative approach (in-depth interviews).

In order to achieve the aims and objectives of this research, several statistical tests were carried out using Statistical Package for the Social Science (SPSS) V.21.

Quantitative data was collected over four months, by addressing the research sample through a web-based questionnaire and in-person visits at their work locations. Data was derived from a web-based dataset and a written counterpart survey that was collected personally. Data was then unified and coded in one dataset and then analysed through different statistical tests, such as the t-test, ANOVA, Pearson correlation and Spearman Correlation.

The qualitative data was collected over a period of one month, by interviewing 25 participants from five public organisations in Saudi Arabia. Participants from each organisation were chosen based on three strata (decision makers, IT managers and end users). Hence, a cross-cases analysis was conducted to find out how different organisational structures (functional, dedicated teams and matrix structures) could affect the levels of "turnover intention" and "user requirement delivery" among each organisation's software development staff.

1.6 Thesis Structure

The thesis comprises of eight chapters: Introduction, Literature Review, Research Methodology, Questionnaire Survey Design and Results, Quantitative Analysis and Discussion, Qualitative Analysis And Discussion, Development Of The Motivational Model, and ends with the Conclusion chapter. This structure provides a roadmap of how to validate this study's proposed model, as shown in Figure 4.2, by testing each group of factors empirically. Brief information on each chapter is given below, followed by a diagram of the thesis structure.

Chapter 2: Literature Review presents an overview of the literature on motivation, theories of motivation and motivation in software engineering. Several theories of motivation that are addressed in the research questions are presented in detail. The difficulties in the understanding of motivation in software engineering are discussed, and the quality and reliability of the prior research is investigated and discussed. Literature regarding interpersonal, occupational and organisational factors are covered and addressed in this chapter.

Chapter 3: Research Methodology discusses the problems and design of the research and also explores the quantitative and qualitative research methods considered for the collection and analysis of data. The selected research philosophy, methods, and techniques are discussed in detail.

Chapter 4: Questionnaire Survey Design And Results describes data collection procedures, the structure of the questionnaire survey, the data analysis framework, and the main results. In addition, this chapter includes information regarding the required data, and how the data was obtained and secured, and the method whereby a sample was selected.

Chapter 5: Quantitative Analysis And Discussion provides further analysis and discussion on the questionnaire results. The aims of the analysis include the investigation of the respondent's differences with regard to the factors under study. This chapter explores the approach of the analysis, data analysis framework, and lastly the main findings. In addition, this chapter investigates the statistical correlations and relationships between different groups of factors. Thus, these validated factors are used to develop this study's model.

Chapter 6: Qualitative Analysis And Discussion presents the importance of the qualitative approach used in investigating the influence of the organisational structure on the turnover intention rate in software engineering. This chapter also covers the interview technique adopted and a discussion of the key procedural issues surrounding the collection and analysis of the data. Essentially, data was collected through semi-structured interviews with practitioners in five public organisations in Saudi Arabia. This chapter describes the interview context (data required), interview plans, data collection, discussion of the interview findings.

Chapter 7: Discussion And Model Development encapsulates the findings from all the empirical data collected and presented in Chapters 4, 5 and 6. The importance of the interaction among the three principal components (organisational, occupational and interpersonal factors) is identified, and the way these groups of factors are reflected in the software engineering environment is discussed. The findings are then compared to theories of motivation and previous literature, and subsequently linked in one integrated model. In this chapter, the final model of this research is developed gradually, and the importance of each part of the model is discussed based on the literature and current situation in software engineering environments. Hence, the aim of this research is achieved. At the end of this chapter, the limitations of the research are discussed.

Chapter 8: Conclusion presents the outcome of the thesis. A final summary of this research is to be provided, the contributions from the research identified and recommendations are drawn which will be practised in software engineering environments. Finally possible future avenues of research are discussed.

Accordingly, the structure of this thesis is built upon the suggested roadmap by constructing eight correlated chapters as shown in Figure 1.1.

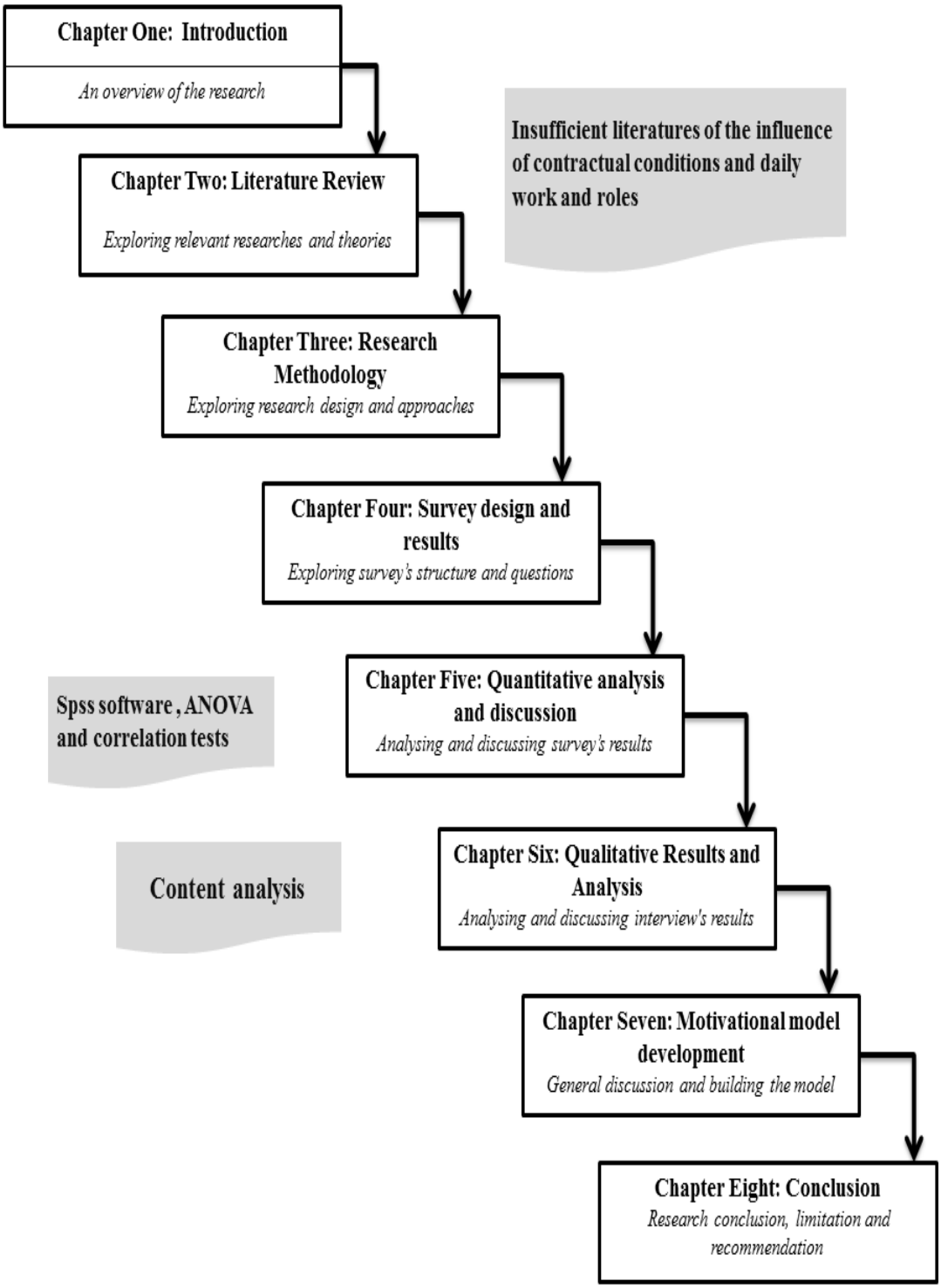


Figure 1.1 Thesis structure

Chapter 2. Literature Review

2.1 Chapter Overview

In the previous chapter (The introduction), the research's aim, objectives and initial model were presented and explained, each part of the construct of this thesis was identified and described briefly. A literature review will now be conducted to establish the background to the research questions, and to cover all relevant theories that are to be tested in this research. This chapter begins with an introduction to the study area and then presents and discusses some selected motivational theories that were chosen to be part of the suggested model presented in Chapter 1.

This chapter reviews the literature in order to identify the current understanding of motivation through interpersonal, occupational and organisational factors, and the impact of these factors on the motivation level of practitioners in software engineering environments. The definition of motivation is investigated, theories of motivation are generally identified and the theories included in the model developed in this study are highlighted and described. Previous studies examining motivation in software engineering environments are also reviewed.

2.2 Introduction

Motivation has been investigated widely in many research fields, such as management, education and health service sectors. However, motivation strategies and techniques are changing over time and vary from one business to another. A few decades ago, motivation was first identified as playing a significant role in software development environments (Couger & Zawacki, 1980). High motivation status could be stemmed from different avenues such as working environments, job security or proper management practices. Although the overlapping between organisational and occupational and interpersonal factors has been witnessed in workplaces, there have been insufficient empirical studies to cover the interaction of the multifactor effects, despite the efforts of previous researchers in modelling and understanding motivation in software development workplaces (Sharp, Baddoo, & Beecham, 2009). Interpersonal factors are found to have a high impact on software engineers' motivation, through the process of fulfilling their personal needs (Moore, Grabsch, & Rotter, 2010), and communication desires (Atwood et al., 1995). In terms of their own needs, although a

limited number of studies have covered this aspect empirically, they do not give an explanation of communication as it occurs, practically, in software development environments, apart from the consensus on the importance of communication in the workplace. Although there are a considerable number of studies concerned with these factors, more detailed research is needed to bridge this gap in the literature.

Moreover, some occupational factors have been identified in different studies which have been found to play significant roles in particular models, such as the job satisfaction model, and psychological contracting (Sharp et al., 2009). However, occupational factors are changing over time and taking different shapes through different workplaces.

In addition, organisational factors have been identified as having an impact on the motivation of software engineers through various practices of leadership and management styles. However, the organisational structure and organisational commitment have not yet been linked to these practices, although it would be expected that adequate organisational environments would pave the way for practicing the motivational techniques effectively.

This chapter provides an overview of various motivation theories and how these theories have been used in understanding motivation drivers, both in general and specifically in the software engineering sector. In addition, the research questions are briefly discussed based on the literature. Each question is answered in full in later chapters.

2.3 **Distinction between Knowledge and Scientific Work**

In the workplace, several activities and knowledge should be practiced at the desired level of quality and professionalism. On the one hand, some of these job types require specific skills and abilities such as: creativity, innovation, problem solving, deep thinking and decision making. This type is called “Knowledge-oriented jobs” (Rus & Lindvall, 2002). One the other hand, other professions require only some sort of compliance with the task’s instructions and guidelines, without any additional development for the process, or interventions in the task procedure. This type could be rooted to the principles of Scientific Management Theory (Taylor, 1911) .

Software development is a rapidly changing, knowledge-intensive business involving many people working in different phases and activities (Rus & Lindvall, 2002). Software organizations expect a rise in productivity due to the increase in needs. Accordingly, Software engineering professions require specific skills and ability to cope with these challenges. However, at the end of each project, software engineering teams need to focus on completing their current project on time, and not on helping the next project manager to succeed, which might lead to the burning of the knowledge.

Another problem with this type of work is that most SE knowledge is not explicit. Organizations have limited ability and time to make knowledge explicit, although there are a few approaches and tools that turn tacit into explicit knowledge. Nevertheless, technology's fast pace often discourages software engineers from analysing the knowledge they gained during the project, believing that sharing the knowledge in the future will not be useful.

In contrast, in scientific work, knowledge is maintained and protected by an organisation's policies and regulations, which helps the organisation's continuity and stability without losing any influential experts. However, this type of job can be suitable for certain types of business such as product manufacturing or production line operators…etc.

It has become evident that knowledge-oriented jobs in many fields, not only software engineering, have some difficulties and challenges because of the type of knowledge required to work in the environment, which couldn't be applied to scientific work.

2.4 **Software Development Methodologies**

Software worldwide is built by adopting interpretable phased approaches in order to accomplish the desired outcomes correctly. According to Cugola, Ghezzi and Milano (1998), the software process can be defined as a collection of methods, practices, activities and transformations that are used to acquire and affirm software and its related products. In the early 1960s, many initiatives were conducted in the hope of producing a systematic process of software development, and these initiatives then contributed to the first concept of the software lifecycle (Royce, 1970). Using the term 'life' as a key word in software development (lifecycle) was a direct sign of the continuous process of building comprehensive software, starting from the first stage until the last stage, which is deployment and maintenance.

Many debates have arisen recently with regard to the issue of how software development processes should be managed and organised in order to deliver successful software on time, and on budget. According to Royce (1987), the waterfall lifecycle model is widely known as the idealised form of a lifecycle as the development phases consist of a fixed sequence of well-defined (and often automated) processing steps as shown in Figure 2.1.

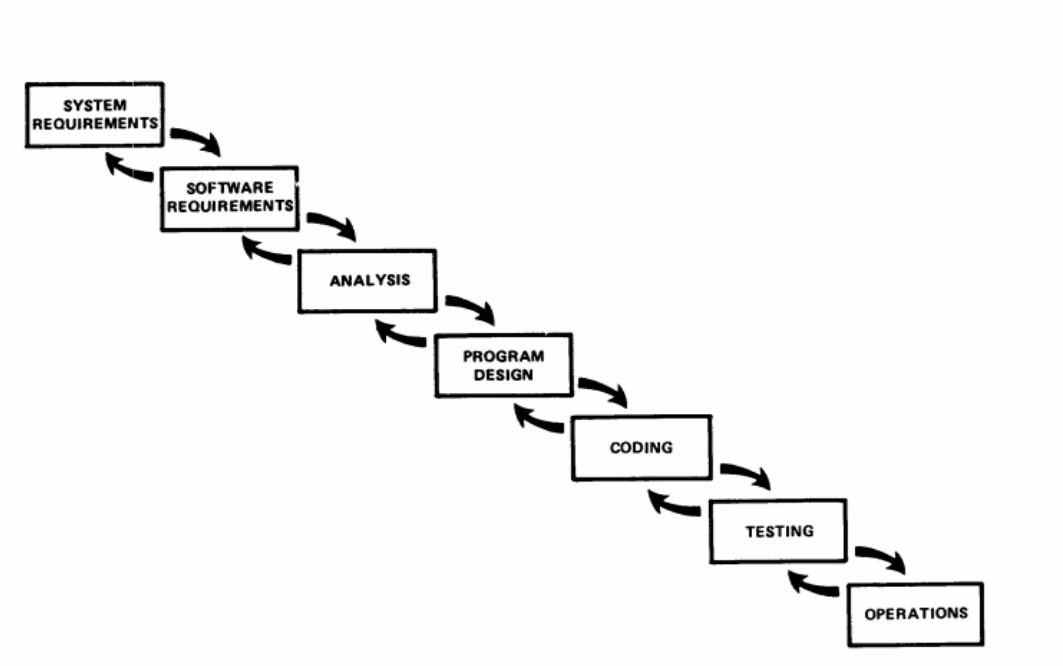


Figure 2.1 Waterfall lifecycle (Royce, 1987)

Although the waterfall model works perfectly in many types of engineering or any other predictable manufacturing sectors, there is lots of evidence that it is not the best choice for software engineering development (Cohn, 2005; Larman, 2003).

Recently, a significantly different approach has been introduced by a group of experienced practitioners who have labelled their new approach 'Agile software development'. This change has been the most noticeable change to the software process development in the last 15 years.

2.4.1 **Agile Methodology in Information Systems Development**

A consensus was reached in early 2001 during a large gathering of 17 practitioners and developers of the 'lightweight' approaches like Extreme Programming (XP), Dynamics Systems Development Method (DSDM), Adaptive Software Development (ASD), Scrum, Crystal Methods, Feature-Driven Development (FDD) and others. Since the

term Agile has become widespread amongst software development groups and practitioners, it has become natural to understand the importance of flexibility in this approach by increasing the level of a project's communication and collaboration. In addition, the Agile methodology is a philosophy or a way of thinking about software development and there is no single unified Agile methodology to follow (Shore and Warden, 2008).

Agile is neither a constrained methodology nor a working plan, rather it is an approach to software development and project building that concentrates on project management and teamwork on top of programming techniques (Fox, Sillito and Maurer, 2008; Hussain, Slany and Holzinger, 2009; Rannikko, 2011; Williams and Ferguson, 2007).

The term Agile in IS development has become highly related to the iterative and incremental software development methodologies that put many practices at the centre of the process (Pathak & Saha, 2013). More emphasis has been put on people, communication and the ability to adapt to change rather than the process, tools and predictive planning. The methodologies "are processes that support the agile philosophy" (Shore and Warden, 2008). Moreover, Pathak (2013) states that agility, for a software development organisation, is the power of software to choose and react expeditiously and fittingly to various changes in its surroundings and to the demands imposed by these surroundings.

According to Beck (2001a), the manifesto has uncovered the following four main fundamentals of the Agile approach:

A. Individuals and interactions over processes and tools.
B. Working software over comprehensive documentation.
C. Customer collaboration over contract negotiation.
D. Responding to change over following a plan.

According to Beck (2001b), these four principles have been described and elaborated in the following 12 points:

1. The highest priority is to satisfy the customer through early and continuous delivery of valuable software.
2. Welcome changing requirements, even late in development. Agile processes tackle change for the customer's competitive advantage.

3. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference for the shorter timescale.
4. Business people and developers must work together daily throughout the project.
5. Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.
6. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
7. Working software is the primary measure of progress.
8. Agile processes promote sustainable development. The sponsors, developers and users should be able to maintain a constant pace indefinitely.
9. Continuous attention to technical excellence and good design enhances agility.
10. Simplicity – the art of maximising the amount of work not done – is essential.
11. The best architecture, requirements and designs emerge from self-organising teams.
12. At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behaviour accordingly.

2.4.2 **Extreme Programming (XP) and Agile**

Extreme Programming (XP) is considered one of the most common methodologies used in the IS development sector. Similar to Agile it supports things like discarding phases and requirements gathering but carries out all of the phases at the same time in the iteration processes, therefore Agile and XP have the same main idea (Toxboe, 2005).

On the one hand, XP is an explorative approach, on the other Agile aims to satisfy customers through early and continuous delivery of a valuable piece of software. Nonetheless, XP accepts changing requirements during the whole development stage and hence is willing to complete any new requirements through its short iterations (2-4 weeks).

XP and Agile integration would definitely help steer the project in the right direction, which in turn decreases the risk of failure (Kent Beck et al., 2001). Collective code ownership is an important part of XP and is enforced by continuous testing and pair programming (Toxboe, 2005).

In general, XP consists of a set of player practices that when put together produce successful software practice. However XP has two main kinds of individual in its practices, the customer (either user or owner) and the developer.

An XP working model was suggested by D-B. Cao (2006) as shown in Figure 2.2 :

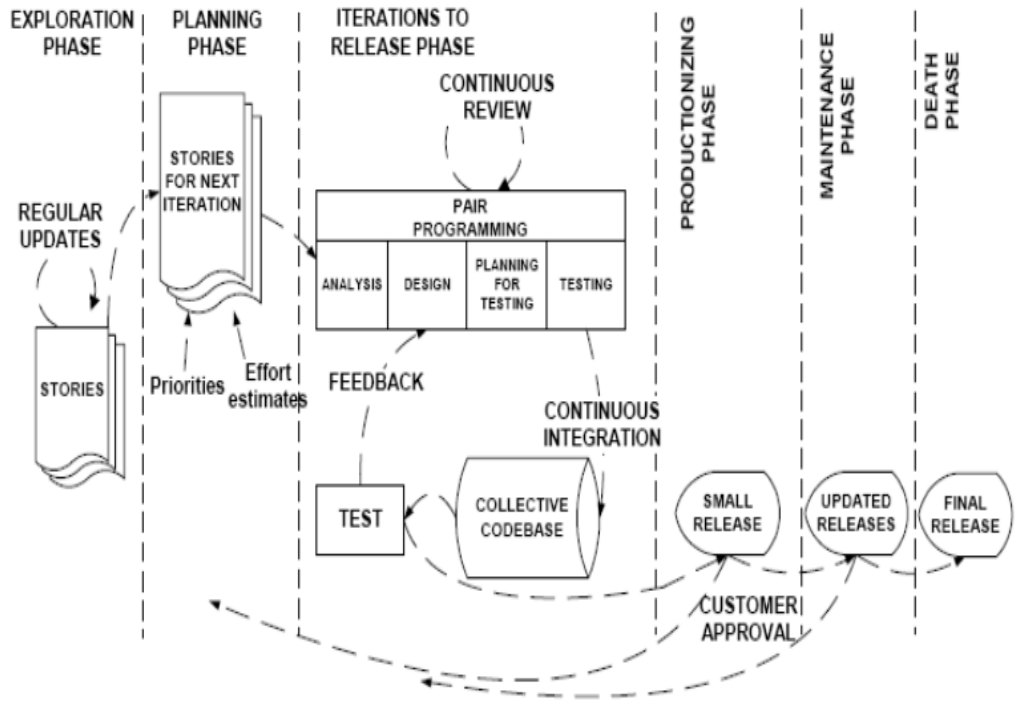


Figure 2.2 XP working model (D-B Cao 2006)

The team is the main component in XP. The team may consist of developers who create the software, testers who are responsible for providing quality assurance, analysts who help design, and the customer representative who provides feedback. The customer representative may be the actual end user of the system. (Jeffries, 2001; Pathak & Saha, 2013; Toxboe, 2005).

Planning is very effective because the product is visible all the time. There are two types of planning in XP methodology:

A. Release planning: By estimating how difficult it is to develop the required features and deliver them to the customer an initial release is decided based on all the constraints and technical challenges.

B. Iteration planning: Individual story iterations have shorter time spans of a few weeks. The customer presents the features that need to be developed over the next iteration. Based on the features presented, the team estimates the time and cost that may be involved. Also, each iteration helps to learn more about the product. (Jeffries, 2001)

2.4.3 **Scrum Methodology**

Scrum is another lightweight method used for the development of software (Pathak & Saha, 2013). According to Larman (2003), Scrum is an information systems methodology that focuses on project management principles and practices rather than long requirements, implementation and so on. It can be considered an inevitable complement to other methodologies. Scrum and XP are often integrated and used together as a single comprehensive software development process (Rannikko, 2011). Scrum was created by Jeff Sutherland and Ken Schwaber and was first published in 1995 (Larman, 2003). It is guided by five main values: commitment, focus, openness, respect and courage ('Scrum Alliance – Scrum 101', n.d.).

According to the Scrum Alliance website, Scrum is based on (paraphrased from the Agile Manifesto):

1. Individuals and interactions over processes and tools.
2. Completed functionality over comprehensive documentation.
3. Customer collaboration over contract negotiation.
4. Responding to change over following a plan.

True success with the Scrum framework comes from teams and organisations who understand these values and the principles that form the foundation of all Agile processes.

Scrum is made up of three roles, four ceremonies and three artefacts ('Scrum Alliance – Scrum 101', n.d.).

There are four main roles in Scrum as follows:

- Product owner: responsible for the business value of the project.
- Scrum master: ensures that the team is functional and productive.
- Team: self-organises to get the work done.

- The end user who can be considered as one of the team.

In addition, SCRUM has four ceremonies (or main points) as follows:

- Sprint planning: the team meets with the product owner to choose a set of work to deliver during a sprint.
- Daily scrum: the team meets each day to share struggles and progress.
- Sprint reviews: the team demonstrates to the product owner what it has completed during the sprint.
- Sprint retrospectives: the team looks for ways to improve the product and the process.

A model of SCRUM process has been introduced by (Wake, 2007) is shown in Figure 2.3.

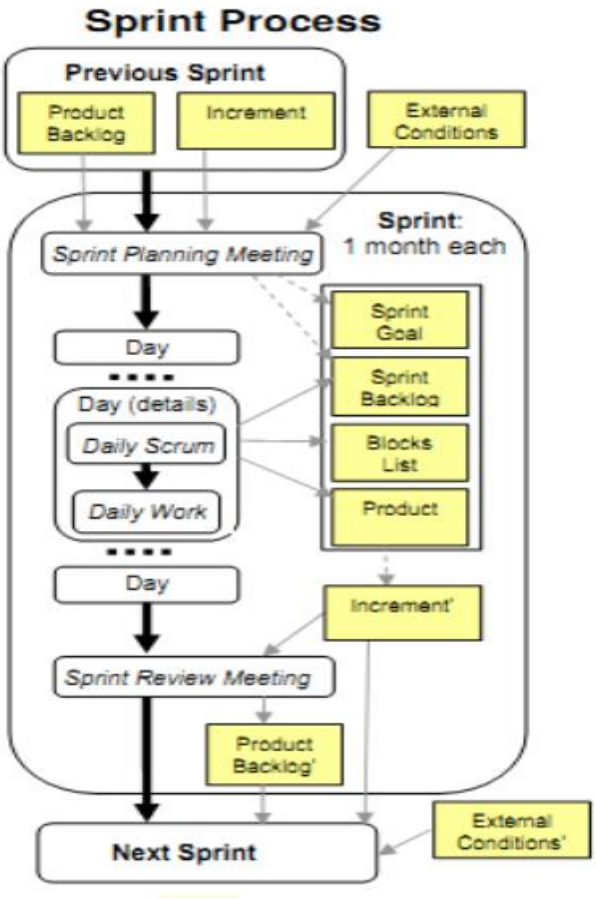


Figure 2.3 SCRUM processes (Wake, 2007)

The Scrum team job is to execute the backlog requirements, and therefore resolve all the problems recorded on the backlog. The sprint ends with the system being demonstrated and presented to all the stakeholders (D-B. Cao, 2006). Some Scrum teams have recorded a 10-20% increase in productivity by adopting Scrum practices, also progress is made even when the requirements are not stable (Pathak & Saha, 2013). Scrum is more of a management process rather than a method meant for developing software.

According to Cohn (2004) , there are many rules for Scrum, as shown below:

1. Each sprint must deliver working and fully tested code that demonstrates something of value to the customer.
2. A sprint planning meeting is held at the start of each sprint.
3. The team collectively selects the amount of work for the sprint.
4. The product owner prioritises the product backlog.
5. The product backlog may be added to or re-prioritised at any time.
6. Once a sprint begins, only the team may add work to the sprint backlog.
7. A short Scrum meeting is held every day where team members state what they did yesterday, what they will do today and what obstacles are in the way.
8. Only active participants (pigs) in the sprint may speak during the daily Scrum meeting.
9. The result (working software, no slide shows allowed) of a sprint is demonstrated at a sprint review meeting at the end of the sprint.
10. No more than two hours may be spent in preparing the review meeting.

2.4.4 **Dynamic Systems Development Method (DSDM)**

According the official DSDM website, DSDM is a robust Agile project management and delivery framework that delivers the right solution at the right time. DSDM can be considered as a framework rather than a method. DSDM has been described as a formalization of RAD (Rapid Application Development) practices (Cockburn & Highsmith, 2001).

DSDM has been providing governance and rigour along with the agility and flexibility demanded by organisations today. The DSDM Philosophy is that any project must be aligned to clearly defined strategic goals and focus upon early delivery of real benefits to the business.

DSDM is designed to be easily tailored and used in conjunction with traditional methods such as PRINCE2® or to complement other Agile approaches such as Scrum.

DSDM lifecycle has seven stages (Pre-Project, Feasibility, Foundations, Exploration, Engineering, Deployment, Post-Project). These stages are illustrated as shown in Figure 2.4.

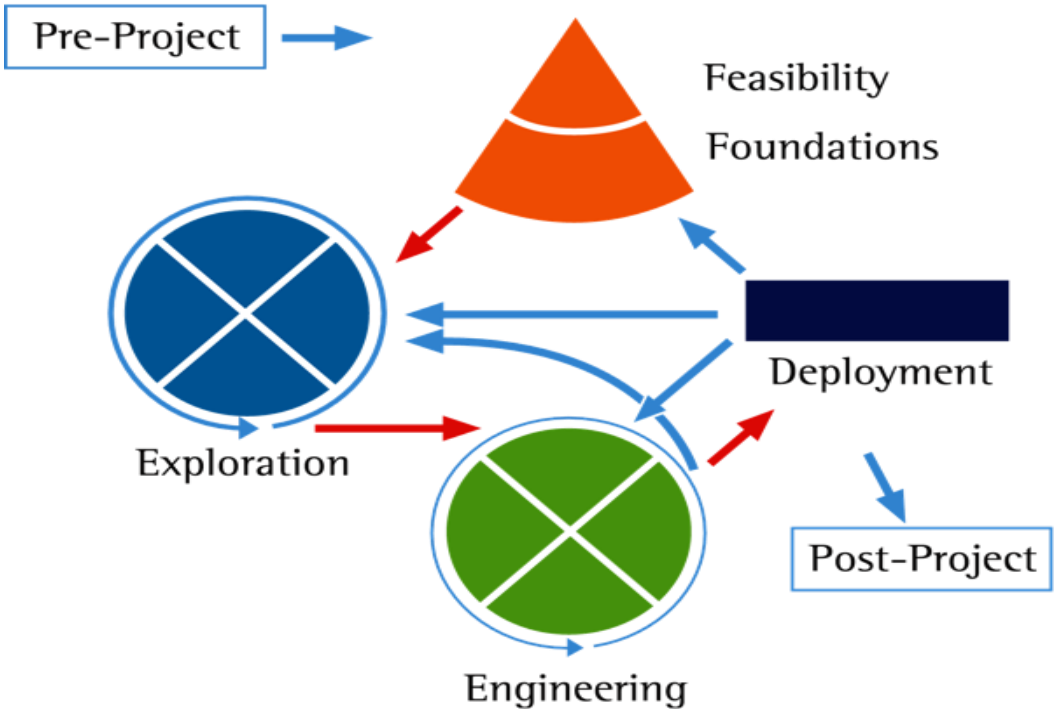


Figure 2.4 DSDM lifecycle

Although DSDM has provided an iterative and incremental framework for software development teams, it does not specifically address team size, exact iteration lengths, distribution, or system criticality such as SCRUM.

2.5 **Socio-Technical Systems**

In a computer system, the software and the hardware are interdependent. Without hardware, a software system is nothing, and without software, hardware is a set of useless electronic devices. However, if you put them together to form a system, you create a useful machine or application (Sommerville, 2011).

Sociotechnical systems have been described as consisting of interacting seven layers as following:

1. The equipment layer: hardware devices and computers.
2. The operating system layer: This layer interacts with the hardware and provides a set of common facilities for higher software layers in the system.
3. The communications and data management layer: This layer extends the operating system facilities and provides an interface that allows interaction with more extensive functionality, such as access to remote systems, access to a system database, etc. This is sometimes called middleware, as it is in between the application and the operating system.
4. The application layer: This layer delivers the application-specific functionality that is required. There may be many different application programs in this layer.
5. The business process layer: At this level, the organizational business processes, which make use of the software system, are defined and enacted.
6. The organizational layer: This layer includes higher-level strategic processes as well as business rules, policies, and norms that should be followed when using the system.
7. The social layer. At this layer, the laws and regulations of society that govern the operation of the system are defined (Sommerville, 2011).

To help understand the effects of systems on organizations, various methodologies have been developed, such as Mumford's ETHICS Method (1983) and Checkland's Soft Systems Methodology (1981; Checkland and Scholes, 1990).

2.5.1 **Soft Systems Methodology (SSM)**

SSM is a methodology used to support and to structure thinking in complex organisational problems. This approach is rooted to the systems engineering field.

SSM provides a logical connection of multiple activities to be as a system. One of SSM's key features is its focus on developing an understanding of the problem (SSM uses the more generic term problematic situation). This understanding takes into account the roles, responsibilities, and concerns of the stakeholders that are associated with the particular problem. The understanding of the problem provides the basis for the solution, which again takes into account stakeholders' differing viewpoints. SSM explicitly acknowledges that the final solution is based on attempting to accommodate the views (and needs) of the various stakeholders. It is believed that problem understanding is one of SSM's principal strengths, but it can also be used to develop

information models of the more technical aspects of a system. It has also been used to evaluate existing information systems (Checkland & Poulter, 2006).

In systems engineering, considering the purpose or objective of the system is the first step in developing the system, as mentioned also in DSDM stages, then working backwards to find ways of achieving that objective.

In case of any organisational problem, SSM has a clear structure to provide the following interventions:

- Finding out about the situation.
- Thinking about systems which are, or might be, employed in the situation.
- Comparing the thinking to the systems which exist in the real world.
- Taking action according to what has been learned.

2.5.2 **ETHICS Methodology**

An ETHICS methodology was used as the overall guiding methodology of the design process in the organisational context. This methodology claims to give as much attention to the needs of the people to get involved in solving organisational issues by technology.

ETHICS (Effective Technical and Human Implementation of Computer Based Systems), is a design methodology developed by Enid Mumford and her colleagues. It promotes user participation as a major element in the system design process. Mumford (1983) described ETHICS as ‘a means of increasing [user] participation and facilitating good communication’. It is widely claimed that user participation in the design of systems is an important factor in their successful implementation.

The ETHICS method emphasises three main objectives that stress the importance of user participation in the design and development in a new system. These objectives are:

- Job Satisfaction.
- Job Efficiency.
- Organisational Activities.

The ETHICS method consists of a set of logical, sequential analytical steps which should be taken when a new computer based work system is being designed. At each

stage business objectives and human needs are taken into account, so that the system is designed specifically to meet these objectives and needs at one and the same time. These stages are:

Stage 1. Diagnosing business and social needs and problems.
Stage 2. Focusing on both short and long term efficiency and job satisfaction.
Stage 3. Setting efficiency and social objectives.
Stage 4. Developing a number of alternative design strategies which will fit efficiency and social objectives.
Stage 5. Choosing the strategy which best achieves both sets of objectives.
Stage 6. Designing this in detail. Implementing the new system.
Stage 7. Evaluating it once it is operational.(Mumford, 2000)

Since EHTICS and SSM methods stress job satisfaction and people participation elements in order to improve system design and usability, it has become essential to investigate how to increase the job satisfaction and interaction levels by adopting different tools and instruments of motivation.

2.6 **Motivation**

Linguistically, motivation derives from the Latin word meaning 'to move' and it is defined in many resources on the internet as "the reason or reasons one has for acting or behaving in a particular way" or "the general desire or willingness of someone to do something". In addition, the motivation concept is used extensively in different fields, such as education, health, economics and psychology.

McConnell (1998) points out that "Motivation is a soft factor: it is difficult to quantify, and it often takes a back seat to other factors that might be less important but are easier to measure" (McConnell, 1998). Every organisation knows that motivation is important, but only a few organisations do anything about it. Daft and Marcic (2008) define motivation as the force or forces that arouse enthusiasm and persistence to pursue a particular course of action.

2.7 **Theories of Motivation**

Motivation theories have put particular emphasis on employees in the workplace and explained how motivation could be perceived as well as fulfilled in different ways. During the 1950s and 1960s, there was a significant development of several founding

theories in motivation studies, most of which have received practical acceptance and support in workplaces. The main motivation theories are listed in Table 2.1, and some of these theories are explained briefly, as they have a direct or indirect influence over the research model presented in Chapter 1.

Table 2.1 Motivation theories

Name	Author
The Scientific Management Theory	Frederick Taylor (1911)
The Köhler Effect Theory	Otto Köhler (1926)
Mayo's effects	Mayo (1930)
Drive Theory	Hull (1943)
Control Theory	Wiener 1948, Miller, Galanter and Pribram (1960)
Hierarchy of Needs Theory	Maslow (1954)
Hygiene Theory	Herzberg (1959)
Theory X and Y	McGregor (1960)
Achievement Theory	McClelland (1961)
Equity Theory	Adams (1963)
Expectancy Theory	Vroom (1964)
Internal-External Control Theory	Rotter (1966)
Activation Theory	Berlyne (1967)
Goal Setting Theory	Locke (1968)
Existence-Relatedness-Growth Theory	Alderfer (1969)
Porter and Lawler model	Porter and Lawler (1971)
Cognitive Evaluation Theory	Deci (1975)
Job Characteristics Theory	Hackman & Oldham (1976)
Stimulus Response Theory	Skinner (1976)
Self-Determination Theory	Deci and Ryan (1985)
The Four Drive Model	Lawrence and Nohria (2002)

Some of the theories listed in Table 2.1 have been given more attention than others in the literature, especially in motivation and management studies. Therefore, some of these are introduced briefly in this chapter.

2.7.1 **Scientific Management Theory**

This theory was introduced in 1911 by Frederick Taylor. Its main concept is to motivate workers monetarily, based on the productivity levels that have been achieved. The central role of managers is to direct and observe them in order to follow quality standards (Taylor, 1911). This theory was criticised for its rigorous approach and the lack of understanding of the social aspects and the dynamic behaviour of the motivation concept. However, its main principles are still being used in different motivational strategies and tools.

2.7.2 **Mayo's effects (Human Relations School of Management)**

In contrast to the scientific management approach, Elton Mayo (1880-1949) believed that workers' motivation could be achieved intrinsically, by supporting their social needs instead of offering monetary incentives. According to the concept of Mayo's effects, workers are not just concerned with money but could be better motivated by having their social needs met whilst at work. Mayo concluded that workers are best motivated by having:

1. Better communication between managers and workers.
2. Greater manager involvement in employees' working lives.
3. Teamworking.(Mayo, 1945).

2.7.3 **Maslow's Hierarchy of Needs**

Maslow's Hierarchy of Needs was developed by Abraham Maslow in 1943, illustrating human needs in a five-level pyramid model. Maslow argued that human motives or needs follow a hierarchy. The lower-order needs, beginning with physiological needs, dominate human motivation and behaviour until they are satisfied. Needs at the next higher level dominate, and so on, up the hierarchy. The most critical need is located at the lowest order and the next most important follows, and so on, up to the top of the pyramid. Each level cannot be met unless the previous one was satisfied. The needs at the bottom of Maslow's pyramid are Physiological Needs such as food, sleep and clothing. At the second level are the needs for Safety and Security, followed by the third order, Social Needs, the fourth order, Esteem and Recognition and the fifth, which is Self-Actualisation. Later on Maslow added Self-Transcendence to the top of his pyramid (Adair, 2009). Transcendence is the need to have personal insights that change

one's world view or view of oneself (Koltko-Rivera, 2006). Moreover, lower order needs are usually met via extrinsic factors (such as pay and rewards), whereas higher level needs are often met through intrinsic factors such as the inherent satisfaction derived from a job (Asad & Dainty, 2005).

2.7.4 **McClelland's Theory of Achievement**

McClelland's Theory of Achievement (1961) states that professionals are motivated based on achievement, power and affiliation. The need for achievement refers to the continuous seeking for success. The need for power reflects the need to manage and control other people and change their behaviour to a way in which they would not have behaved otherwise. The need for affiliation refers to the desire to spend time in establishing and maintaining close interpersonal relationships with others (Buelens, Broeck, Vanderheyden, Kreitner, & Kinicki, 2006; Wood et al., 1994). These three areas of need influence each other. If any project's goals are achieved, then the team's needs will be satisfied and personal needs will be fulfilled (Adair, 2010).

Based on McClelland's Theory of Achievement, people will have different characters based on their dominant motivator. However, the dominant driver could arise from the culture or life experiences (McClelland, 1961). An individual with a high achievement need drive has a strong desire to accomplish challenging goals with continuous feedback and evaluation on his or her progress. In addition, all types of risk are taken into account to be accommodated and mitigated by this individual. The person with a high affiliation need drive has a strong need for friendly relationships and interaction with other people. The affiliation driver produces a motivation and need to be liked and held in popular regard. These people are team players. Lastly, a person with a high power need drive has a strong need to be influential, active and to make an impact. There is a strong need to lead and for their ideas to prevail. There is also motivation towards and need for increasing personal status and prestige (McClelland, 1961).

The fulfilment of each type of these three needs could change an individual's perception towards management and leadership jobs. For instance, high affiliation people tend not to perform well as managers, because of their need to maintain positive social relationships, and not to go through official assessment procedures. People with a high power needs level and low affiliation needs level tend to be successful leaders, while

people with high achievement needs tend to perform well as entrepreneurs (McClelland, 1961; Ramlall, 2004).

2.7.5 **Equity Theory**

Equity Theory was developed by Stacey Adams in 1963, based on the work of Festinger's Cognitive Dissonance Theory (1962). Cognitive Dissonance Theory states that a powerful motive to maintain cognitive consistency can give rise to irrational and sometimes maladaptive behaviour (Festinger, 1962). Adams (1963) describes Cognitive Dissonance Theory as divided into two assumptions. The first, stating that a presence of inequity will create tension and that the amount of degree of tension is variable, depending on the amount of inequity. Secondly, the tension created will drive the possessor to strive to reduce that tension (Adams, 1963). Equity Theory contains three main premises: the first premise states that employees should feel that their efforts are rewarded in a fair and equitable manner (Carrell & Dittrich, 1978; Ramlall, 2004). The second premise states the concept of social comparison, in which employees need to compare their outcomes to their inputs. Inputs consist of skills, education, and effort and outcomes consist of compensation, fringe benefits, promotion, and job status (Adams, 1963; Carrell & Dittrich, 1978). The last premise of the theory suggests that if employees sense themselves to be in an inequitable situation, they will seek to reduce the inequity (Adams, 1963; Carrell & Dittrich, 1978). Therefore, Equity Theory, materialistically, is considered as an internal balancing scale that can argue how fairly an individual is treated in the workplace. The absence of equity will develop an unequal feeling, which might lead eventually to a turnover decision.

The aim of Equity Theory is to understand how people feel that are "equitably treated." It is based on a set of inputs and outputs that must be in balance to make people feel "equitable" (Hall, Baddoo, & Beecham, 2009).

In addition, the concept of Equity was extended by Hatfield and Miles, in 1987, by introducing the concept of Equity Sensitivity, which suggests that individuals react in a consistent manner, but individually different ways to both perceived equity and inequity because they have different preferences for equity. People who have high equity sensitivity are outcome-oriented. They attach great importance to outcomes and they want to get more when giving the same (Yin & Wu, 2009).

In software engineering research, Equity Theory has been discussed in a limited number of studies (10 studies), according to a systematic review conducted by Hall et al. in 2009. However, only five of these articles mentioned the theory explicitly (Hall et al., 2009). The first of these studies was conducted by Dittrich et al. (1985), as they found that the relationship between job satisfaction and equity feelings among information systems personnel could be predicted by the level of equity feeling and the degree of fairness of the supervisor in permitting personal planning and decision making. In addition, they found that the financial equity sense had the second highest level of impact on job satisfaction for both programmers and analysts (Dittrich, Daniel Couger, & Zawacki, 1985).

A motivational model was developed by Ridings and Eder to look at the association between job satisfaction and four types of equity (monetary compensation, perception of career path status, perception of career planning tool availability, and perception of critical decision-making influence). The results revealed that there is no association between job satisfaction and monetary compensation, even though monetary compensation was not equal amongst technical and managerial staff (Ridings & Eder, 1999). Conversely, Agarwal and Ferratt found that financial incentives, assigned work, and recognition are all important factors in predicting the equity feeling among professionals in software engineering environments (Agarwal, & Ferratt, 2001). Furthermore, the sense of equity was found to be an implicit motivator in the software engineering industry (Ritu, Agarwal & Ferratt, 2002)

In conclusion, Equity Theory emphasises the significant importance of individuals' feelings towards two foremost factors: pay rules and recognition for work performed.

2.7.6 **Expectancy Theory of Motivation**

The Expectancy Theory of Motivation, introduced by Victor H. Vroom in 1964, concentrates on the value of outcomes as the primary motivation factor. Unlike Maslow and Herzberg's theories, it does not concentrate on needs. Maslow and Herzberg looked at the relationship between internal needs and the resulting effort expended to fulfil them. Vroom separateed effort, which arises from motivation, from performance and outcomes (Vroom, 1964). Moreover, the Expectancy Theory of Motivation is considered to be one of the best theories that provides a practical explanation of why individuals choose one behavioural option over others (Suciu, Mortan, & Lucretia,

2013). Basically, the idea behind this theory is that a person will exert a higher level of effort towards a specific direction or goal, and hence will be motivated because he or she believes that his or her decision will lead to the desired outcome. Moreover, Expectancy Theory depicts how a person's performance could be increased or decreased based on the value of the rewards and goals (Suciu et al., 2013). Although this theory does not include all an individual's motivation factors, it provides a better understanding of the best ways to motivate subordinates and how they behave within any working context. Vroom's Expectancy Theory consists of three main milestones: efforts, performance and outcomes.

The concept of Expectancy Theory is described as based on these three components;

1. Expectancy: This means the relationship between effort and performance. It could be described as the belief that higher or increased effort will yield better performance. For example, "If I work harder, I will make something better". This component's range is from 0 to 1, where 0 is the feeling of incapacity in performing the assigned task. And 1 is the sense of performing on the highest level.
2. Instrumentality: This means the relationship between performance and outcomes. It could be described as the thought that if an individual performs well, then a valued outcome will come to that individual. Some things that help instrumentality are: having a clear understanding of the relationship between performance and the outcomes, having trust and respect for people who make the decisions on who gets what reward, and seeing transparency in the process of who gets what reward (Redmond, 2009). This component's range is from 0 to 1. Individuals who feel that their current constant performance will take them to the desired outcome could be given a score of (1) in this component.
3. Valence: This could be described as the value degree of these outcomes from the perspective of the individual. Individuals are different in the level of value they associate with any particular outcome. For example, £10 could be valuable for one but nothing for another: "Is the outcome I get of any value to me?" (Redmond, 2009). This component's range is from -1 to 1, where -1 means that the outcome is unsatisfactory and 1 means it is very satisfactory.

Vroom's Theory concludes that the force of motivation in an employee could be calculated quantitatively by using the following simple equation:

*Motivation = Valence * Expectancy * Instrumentality*

2.7.7 **Herzberg's Two-Factor Theory**

Herzberg's Two-Factor Theory was introduced by Frederick Herzberg in 1968. This theory proposed one of the best-known analyses of motivational issues by classifying motivational tools into two groups, which also emphasises the importance of Maslow's higher-order needs in motivating individuals in organisations. From multiple studies involving about 2,000 respondents in numerous occupational categories, he and his colleagues concluded that two major factors influenced an individual's motivation in work settings: "motivators" and "hygiene factors" (Herzberg, 1993). The hygiene factors represent the first three steps of Maslow's needs, i.e., physiological needs, security and safety, and social needs (Lester, 2014). The insufficiency of hygiene factors in the workplace could contribute to dissatisfaction with the situation, but the presence of hygiene factors, however, does not ensure high levels of satisfaction. Hygiene factors are seen to be extrinsic both to the work itself and to the individual, involving organisational, group, or supervisory conditions or externally mediated rewards, such as salary. While hygiene factors could only prevent dissatisfaction, motivators, on the other hand, produced a heightened level of satisfaction and increased motivation intrinsically, through interest and enjoyment of the work itself, as well as a sense of growth, achievement, and fulfilment of other higher-order needs defined by Maslow (Golembiewski, 2000) . More importantly, Herzberg viewed pay and money as hygiene factors, in direct contrast to Taylor, who viewed money as the key driver of people's motivation.

2.7.8 **Goal-Setting Theory**

Goal Setting Theory was introduced by Edwin Locke and his colleagues in 1968. This theory has been acknowledged as the most successful work motivation theory (Golembiewski, 2000). Setting goals refers to the efforts being made to clarify goals and make them specific, measurable, achievable, realistic, and time targeted (Blanchard, Zigarmi, Zigarmi, & Dowdy, 1985). Goals could be a very effective tool for increasing employees motivation if they are appropriately managed since there is a strong relationship between goals and performance (Locke & Latham, 2002).

The lack of management tools to monitor employees' performance and ensure that they are on the right track during task performance has motivated many researchers in management and psychology fields to suggest alternative tools rather than direct coercion by managers.

Goal Setting Theory states that more challenging and clear goals lead to a higher performance level by the performer. Therefore, the two major premises of goal-setting theory pertain to the effects of goal difficulty and goal specificity on task performance (Gambill, Clark, & Wilkes, 2000). Setting goals could lead to many desirable outcomes in four ways:

1. Choice: by narrowing performer's attention and directing his efforts to goal-relevant activities.
2. Effort: by supporting the sense of challenge to achieve higher production level.
3. Persistence: by promoting the sense of the capability to overcome the obstacles.
4. Cognition: by developing the performer's behaviour through the feeling of success and gaining more knowledge. (Latham, 2004)

In addition, Gutknecht and Miller list three requirements for goal setting:

1. Proper goal definition: knowing its purpose and the needs to be fulfilled.
2. Specific, exact goals which are definable, measurable, challenging, and attainable.
3. Feedback: knowing how well the goal is being attained. (Gutknecht & Miller, 1990)

Moreover, according to Gambill et al., (2000) Goal-Setting Theory involves four key variables: participation in goal setting, goals specificity, goals difficulty, and feedback on progress in meeting goals.

Furthermore, commitment to the goals and continuous feedback are also necessary for higher performance. Many studies have sought to refine the dynamics and details of these effects of specific, challenging and accepted goals. For example, research findings also indicated that participation in goal setting enhances commitment to the goal more than a curt directive to pursue the goals. Participation, however, does not enhance commitment as much as providing a convincing rationale for the assigned goal (Lee et al., 1991; Locke and Lee, 1986).

In the software engineering industry, a limited amount of research has been conducted to examine the impact of different goal-setting components on project members' motivational level. Tasks in software engineering are considered highly challenging and require specific types of skills and knowledge.

An empirical study was conducted by Rasch and Tosi in 1992 on the factors that affect software developers' motivation in the industry. The results indicated that goal difficulty had a negative relationship with performance but a positive relationship with effort. However, the degree of difficulty of organisational goals had a relatively small overall effect on performance. Goal clarity, also had a relatively small overall effect on performance (Rasch & Tosi, 1992).

In summary, Goal-Setting Theory suggests that, overall, attractive goals need to have the following characteristics: clarity, challenge, commitment, feedback and complexity.

2.7.9 **Self-Determination Theory for Intrinsic and Extrinsic Motivation**

Self-Determination Theory (SDT) is a theory of motivation which is concerned with supporting the natural or intrinsic tendencies to behave in effective and healthy ways. SDT has been researched and practised by a network of researchers around the world. This theory was initially developed by Edward L. Deci and Richard M. Ryan in (1984), and has been elaborated and refined by scholars from many countries. Moreover, SDT addresses the importance of human needs, values, intrinsic motivation, development, motivation across cultures, individual differences, and psychological well-being. Therefore, SDT studies have covered most of the business and academic fields, including Education, Healthcare, Relationships, Psychotherapy, Psychopathology, Organisations, Sports and Exercise and the Environment.

Cognitive Evaluation Theory (CET), also presented by Deci and Ryan (1985), is considered a sub-theory of self-determination theory, and suggests that interpersonal events and structures (e.g., rewards, communications, feedback) that lead to the feeling of competence during action could enhance intrinsic motivation for that work, because they allow satisfaction of the basic psychological need for competence.

SDT is considered as a formal meta-theory that defines intrinsic and various extrinsic sources of motivation and provides a description of the respective roles of intrinsic and extrinsic motivation in cognitive and social development and in individual differences.

Intrinsic and extrinsic types of motivation have been widely investigated, and the distinction between them has shed light on workplace practices. Intrinsic motivation remains an important construct, reflecting the natural human propensity to perform. However, extrinsic motivation is argued to vary considerably in its relative degree of autonomy and thus could either reflect external control or true self-regulation.

Intrinsic motivation is defined as the doing of an activity for its inherent satisfactions rather than for some separable consequence (Ryan & Deci, 2000), while extrinsic motivation refers to doing something because it leads to a separable outcome (Ryan & Deci, 2000) and also to satisfying the performer through other's performance, influence and attitudes (Johns, 1996).

In terms of intrinsic motivation, SDT proposes that individuals have three innate psychological needs: ***competence, autonomy, and relatedness*** (Deci and Ryan 2000).

Firstly, the need for competence is defined as an individual's deep desire to feel competent in the interaction with the surrounding environment (Ryan & Deci, 2000; White, 1959). Secondly, the need for autonomy represents an individual's inherent desire to feel volitional and to experience a sense of choice when performing an activity (de Charms, 2013). Finally, the need for relatedness is defined as an individual's inherent tendency to feel affiliated with others through a cohesive group membership (Baumeister & Leary, 1995). Moreover, this need is satisfied when people experience a sense of community and develop close and intimate relationships with others (Deci & Ryan, 2000).

Self-Determination Theory proposes that extrinsic motivation varies considerably from intrinsic motivation in the degree to which it is autonomous and self-determined (Ryan & Deci, 2000). Extrinsic motivation has been classified based on the types of autonomy level as follows:

1. External regulation: where motivation is driven by an external object or person. This kind of motivation is recognised by operant theorists, (e.g., Skinner, 1953).
2. Introjected regulation: this type describes a type of internal management that is still quite controlling, because people perform such actions with the feeling of pressure in order to avoid guilt or anxiety or to attain ego-enhancements or pride.

3. Identification: where the person has identified with the personal importance of behaviour and has thus accepted its regulation as his or her own.
4. Integrated regulation: this type occurs when identified regulations have been fully assimilated into the self. This occurs through self-examination and bringing new regulations into congruence with one's other values and needs (Ryan & Deci, 2000).

2.7.10 **Theories of Motivation: Summary**

Motivation is defined as "The willingness to exert a high level of effort towards organisational goals, conditioned by efforts, and ability to satisfy some individual needs." (Robbins & Judge, 2012)

Accordingly, it has been seen that the meaning of individual need has been interpreted differently in many places in the list of motivation theories by two types of scientists, physiologists and psychologists. The former have emphasized the presence of tangible outcomes in order to motivate people to behave in a certain way, e. g, alleviation of hunger or thirst, whereas the latter have said that need creates an internal challenge to behave in certain way e.g. a strong need for progress. Thompson and McHugh, categorise motivation theories into two different themes: *content theories* and *process theory*. The content theories examine what motivates people through concepts such as needs, goals and motivators, for example those of Maslow, McClelland and Herzberg, whereas process theories examine how behaviours are selected, directed, initiated and maintained, as the work of Porter and Lawler and Vroom explains. (Thompson & McHugh, 2002)

Although all of these theories try to show their applicability in understanding workers' motivation, some of the concepts of these theories were driven through the concepts of other theories, but in different ways. For example, Equity Theory could be understood from Expectancy Theory, as the worker considered both the outcome and the income in determining the exerted efforts needed, and then compared his or her outcomes to others' outcomes, to find out how fairly she/he was treated. However, the theories presented in this chapter do not present a clear picture of motivation. Many of them overlap, address issues at different levels of abstraction, and, occasionally, contradict each other. Indeed, many of the theories do not acknowledge the existence of other

theories (Hall et al., 2009). Therefore, fitting the theories together to form a comprehensive, clear, and unambiguous picture is difficult.

2.8 Motivation in Software Engineering

Social science is considered as the foundation and wider framework underlying all motivation strategies and models (Beecham and Hall, 2007). Motivation refers to the initiation, direction, intensity and persistence of behaviour (Beecham, Sharp, & Baddoo, 2007). It is acknowledged to have a significant impact on software quality and productivity (McConnell, 1998). Concentration by software engineering managers on traditional motivation methods like rewards and recognition for software engineers may be misguided, as some studies have suggested that software engineers have a distinctive personality profile and could be motivated naturally by their job, e.g. through challenging technical problems and peer interaction (Sharp et al., 2009). Likewise, as in any professions, motivation plans are generally considered to be tailored specifically to this profession, as the nature of the work and related factors might change motivational drives.

Motivation studies have covered several industrial professions, such as nursing, education, manufacturing, physical sports and hospitality. However, the software development industry has not received the same attention as these other fields.

2.8.1 The Nature of Software Engineering Professions

Similar to some professions, software engineering can be considered as a knowledge-oriented profession, which means that if a software engineer leaves his/her organisation, the knowledge possessed by that person will also go with that person (Rehman et al., 2011). Therefore, the Knowledge-Based software engineering approach believes in sharing knowledge and making it available to all project stakeholders, including developers, teams and managers. This is intended to facilitate the timely production of high-quality software (Selfridge, 1992).

An early study was conducted by Woodruff in 1980 by applying the ‘Personality Research Form’ from behavioural psychology on people in the IS field which found slightly significant differences between IS personnel and personnel from other fields. These results were supported by those of similar work by Cougar and Zawacki, in 1980, (cited in Gambill et al., 2000).

A limited number of studies have been conducted on the distinguishing character features of software engineering personnel. However, even at an early stage of Information Systems development, studies of Information Systems personnel have reported that personnel in Information Systems are different from those in any other profession (Davis, 1989). Cougar and Zawacki in 1989, using a modified version of the Job Diagnostic Survey with 2500 IS personnel, concluded that IS personnel were significantly different from people in other professions, as they had a lower level at the social needs measure and a higher level at the growth needs' measures (Couger, 1989).

Software engineers are noticeably different from many other professions in terms of their needs and desires, as they look for one or some of the following components: variety, challenging identity as part of a group, competent supervisors, feedback, being able to contribute, involvement in personal goals, stability (Beecham & Hall, 2007). According to a systematic literature review conducted by Sharp et al. (2009), many studies have concentrated on the most recurrent needs and characteristics of software engineers, which are: being growth orientated (e.g. challenging, learning new skills), being introverted (low need for social interaction) and being autonomous (need for independence). Furthermore, the software engineering job itself is considered an important motivation, for the following reasons (Sharp et al., 2009):

1. Change in working routine (four studies).
2. Challenge (software engineering is a challenging profession and that in itself is motivating) (four studies).
3. Problem-solving (the process of understanding and solving a problem in programming terms) (three studies).
4. Benefit (creating something that is of benefit to someone or enhances well-being) (three studies).
5. Team working (two studies).
6. Science (making observations, identifying, describing, engineering, investigating and theorising, explaining a phenomenon) (two studies).
7. Experiment (trying something new, experimentation in order to gain experience) (two studies).
8. Development practices (object oriented, XP and prototyping practices) (two studies).

9. Software process/lifecycle – software development, project initiation and feasibility studies, and maintenance (one study).

2.8.2 **Motivation and De-motivation in Software Engineering**

Few systematic reviews have been carried out in the last decade with regard to software engineering motivation. The two main reviews were from Beecham et al., in 2008 and Franca & Gouveia, in 2011. The systematic review of the literature conducted by Beecham, Baddoo, & Hall (2008) reviewed over 92 published studies in software engineering, which revealed a list of motivators, as shown in Table 2.2, as well as a list of de-motivators, as shown in Table 2.3.

Table 2.2 Motivators in software engineering (Baddoo & Beecham, 2008)

#	**Motivators**	**Frequency** No. of studies
1	Rewards and incentives	14
2	Development needs to be addressed	11
3	Variety of work	14
4	Career path	15
5	Empowerment/responsibility	6
6	Good management	16
7	Sense of belonging/supportive relationships	14
8	Work/life balance	7
9	Working in a successful company	2
10	Employee participation/involvement/working with others	16
11	Feedback	10
12	Recognition	12
13	Equity	3
14	Trust/respect	4
15	Technically challenging work	11
16	Job security/stable environment	10
17	Identify with the task	20
18	Autonomy	9
19	Appropriate working conditions/environment/good equipment/tools/physical space/quiet	6

20	Making a contribution/task significance	6
21	Sufficient resources	2

Table 2.3 De-motivators (Baddoo & Beecham, 2008)

#	**De-Motivators**	**Frequency** No. of studies
1	Risk	1
2	Stress	5
3	Inequity	4
4	Interesting work going to other parties	1
5	Unfair reward system	2
6	Lack of promotion opportunities/stagnation/career plateau/boring work/ poor job-fit	5
7	Poor communication	5
8	Uncompetitive pay/poor pay/unpaid overtime	6
9	Unrealistic goals/phoney deadlines	4
10	Bad relationship with users and colleagues	4
11	Poor working environment	9
12	Poor management	7
13	Producing poor quality software	3
14	Poor cultural fit/stereotyping/role ambiguity	3
15	Lack of influence/not involved in decision-making/no voice	2

The next systematic literature review of motivation in software engineering, carried out by Franca and Gouveia, in 2011 and covering 53 published papers, revealed an updated list of motivators in software engineering environments, adding 8 motivators to the previous list presented by Beecham in 2008. The new, added motivators are shown in Table 2.4 and they also identified one additional de-motivator, which is Task Complexity (França & Gouveia, 2011).

Table 2.4 New motivators: Franca (2011)

#	**Motivators**	**Frequency** No. of studies
1	Team quality	4
2	Creativity/innovation	4
3	Fun	1
4	Professionalism	2
5	Having an ideology	1
6	Non-financial benefits	1
7	Penalty policies	1
8	Good relationship with users/customers	2

The motivation and de-motivation factors in both the 2008 and 2011 systematic literature reviews showed a variation in frequency. This variation might give an unclear sign regarding the stability of each motivator in software engineering environments. However, assessing the value and effect of a factor was not the intention of either systematic literature review. The addition of 8 motivators and 1 de-motivator supports claims that the motivation of software engineers has evolved since the majority of earlier research was conducted (Sharp and Hall, 2009), and suggests that motivation will continue to change as the discipline evolves, necessitating further research. Therefore, the reliability and accuracy of the studies reviewed in the Beecham et al.'s systematic literature review were unclear. Over 80% of the reviewed studies collected their data through questionnaires, either in-hand questionnaires or online remotely administered questionnaires.

2.9 **Models of Motivation in Software Engineering**

Several models of motivation have been developed specifically for the software engineering sector. Each model has been designed and developed intentionally, based on a particular perception.

The dynamic behaviour of motivation has led scientists to explain motivation from different perspectives. Furthermore, some motivation models have been developed from the perspective of management and administration while others have focused on job

satisfaction levels. However, according to Sharp et al. (2009), the most common models are those listed in the following subsections.

2.9.1 **The Job Characteristics Model (JCM)**

Job structures vary from one field to another. Each job has its own design, characteristics, requirements, advantages and disadvantages. However, each of these criteria has an impact on the job's expected outcomes. Hackman and Oldham, in 1976, introduced the Job Characteristics Model, which is widely known as a practical framework to understand how particular job characteristics could influence job satisfaction and, in turn, job outcomes (Hackman and Oldham, 1976). The model (JCM), as shown in Figure 2.5, consists of five influencer job characteristics: skill variety, task identity, task significance, autonomy and feedback. These have an impact on three critical psychological states: experienced meaningfulness, experienced responsibility for outcomes and knowledge of the actual results. In turn, these affect the expected work outcomes including job satisfaction, absenteeism and work motivation. In other words, job characteristics could affect employees' attitudes and behaviours within any working context. Furthermore, JCM was further enhanced in favour of software engineering by Couger and Zawacki (1980). This enhancement added new job dimensions to the existing general model in order to put more emphasis on 'data personnel'. The enhanced model also shows social need strength as a mitigating factor in practitioners' motivation. The new additions are underlined (Sharp et al., 2009).

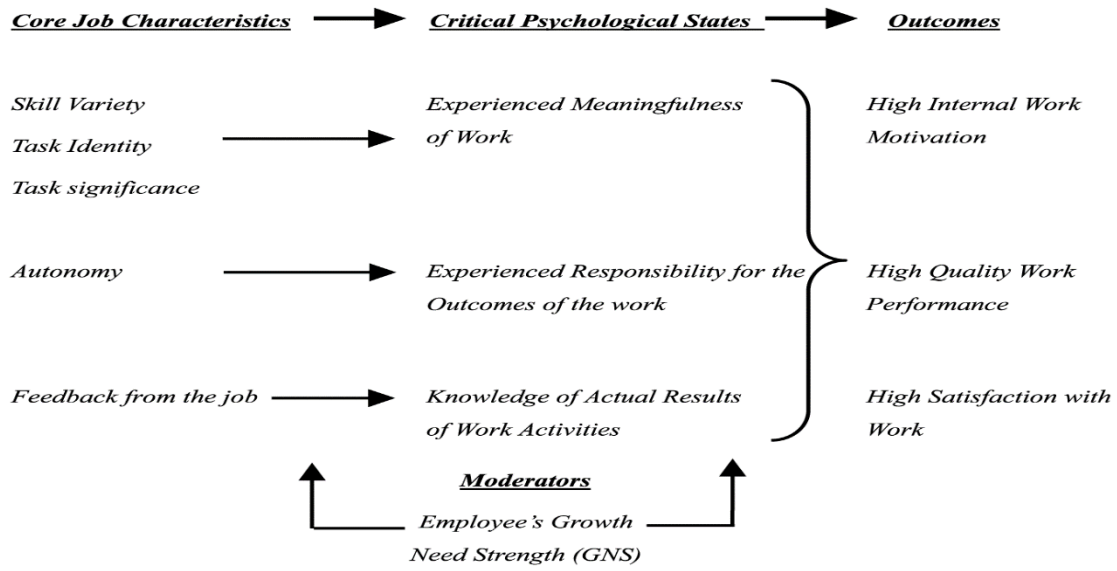


Figure 2.5 Job Characteristics Model (Sharp, Baddoo, Beecham, Hall, & Robinson, 2009)

The Job Characteristics Model was validated by Fried and Ferris (1987) by combining all the five cores in one numerical value, called the Motivating Potential Score (MPS). This validation could be carried out using the following formula:

$$MPS = \frac{\text{Skill Variety} + \text{Task Identity} + \text{Task Significance}}{3} \times \text{Autonomy} \times \text{Feedback}$$

Figure 2.6 Motivating Potential Score (Sharp et al., 2009)

In conclusion, this model has gained its strength from both the theoretical and mathematical approaches that it provides in the workplace. The application of this model's formula will generate the Motivating Potential Score (MPS), which would reflect how much this job meets the five principles of JCM: the higher scores, the more highly-motivated the individual is expected to be.

2.9.2 **One-factor Component Models**

Some factors independently play a significant role in motivating employees or even changing their behaviour towards work. Many of these factors have been investigated in depth and thoroughly investigated. Leadership style is one of the most influential factors that could affect employees' motivation. Gross (1997) noted seven interrelated areas that team champions need to address:

1. Leadership.

2. Values and cultures.
3. Work processes and business systems.
4. Organisation, team and job design.
5. Individual and team competencies.
6. Management processes and systems.
7. Reward and recognition.

Moreover, leadership style could considerably influence knowledge-sharing dynamics and thus increase the motivation level in the working environment, which would accordingly lead to highly motivated staff (Waheed, Qureshi, Khan and Hijazi, 2013). According to Bass, Avolio, Jung and Berson (2003), based on employees' behavioural interactions and responses, there are two main styles of leadership: transformational and transactional. The difference between these two styles is that a transformational leader focuses on stimulating and inspiring his or her followers intellectually, as well as convincing them about an unseen future and undertaking plans, whereas a transactional leader interacts with his or her subordinates frequently and induces them to obtain the desired performance.

Several models have been developed with regard to the notion of the impact of organisational and managerial factors on employees expected outcomes. A model was introduced by Santana and Robey (1995), which suggests that managerial, team member or self-control of tasks influences the level of job satisfaction felt by an employee. This model is shown in Figure 2.8.

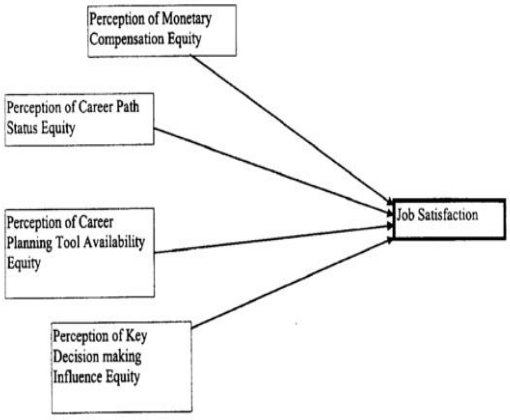


Figure 2.7 Ridings and Eder's JS Model (1999)

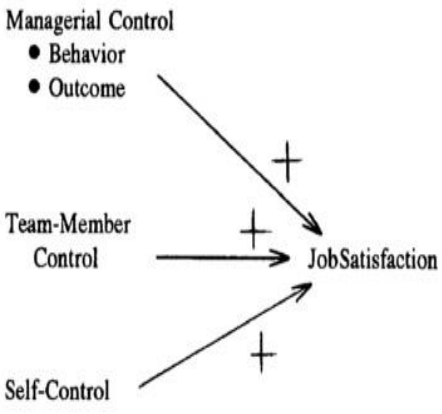


Figure 2.8 Santana and Robey's Job Satisfaction Model

(1995)

A further model was introduced by Ridings and Eder (1999), which focused on intrinsic motivation and the effect of the career path on IS technical employees' attitudes compared with those of their peers who work in managerial professions (see Figure 2.7 Ridings and Eder's JS Model).

Another model, designed by Frangos (1997), highlighted a synchronised correlation between work environment and management quality. His model reflected how the working environment and management procedures could motivate or demotivate the software engineer. The highest level of motivation named in this model (euphoria) could be achieved through the best working environment, in conjunction with the best leaders in the organisation, and the lowest level is vice versa.

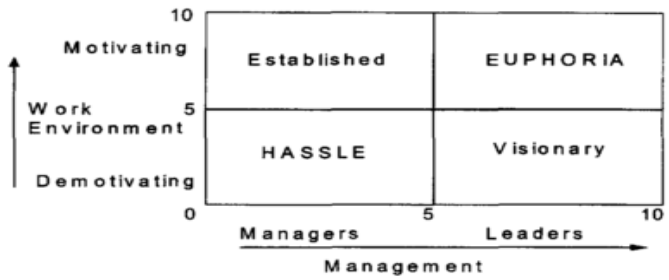


Figure 2.9 Frangos' JS Model (1997)

More recent research has been conducted by Li, Tan and Teo (2012) with regard to the relationship between leadership style and IS team motivation within open source development communities. They found that the transformational leadership style has a positive relationship with a developer's intrinsic motivation and that the leader's active management style is positively related to the developer's extrinsic motivation. Moreover, they adopt a path-goal theory in describing the effect of leaders' behaviour on subordinates' motivation levels, thereby increasing the aimed-for outcomes, as shown in Figure 2.10.

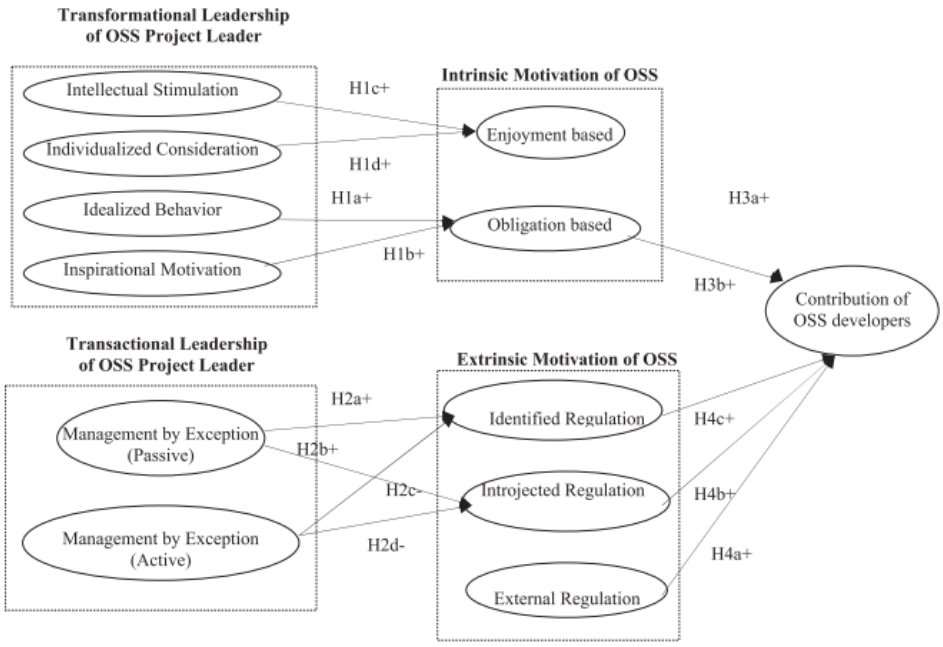


Figure 2.10 Leadership and JS Model, Li, Tan and Teo (2012)

Furthermore, studies on leadership have considered four aspects of leadership, which are power influence, behaviour, trait and situational (Li et al., 2012).

2.9.3 **Models exploring the relationship between two different components**

Some literature puts emphasis on the effect of one factor on another with regard to motivational level. Initially, Mak and Sockel (2001) introduced a model which showed that certain factors like job satisfaction, perception of management on career development, loyalty, burnout and turnover intent could be considered as indicator variables for motivation and retention (Figure 2.11).

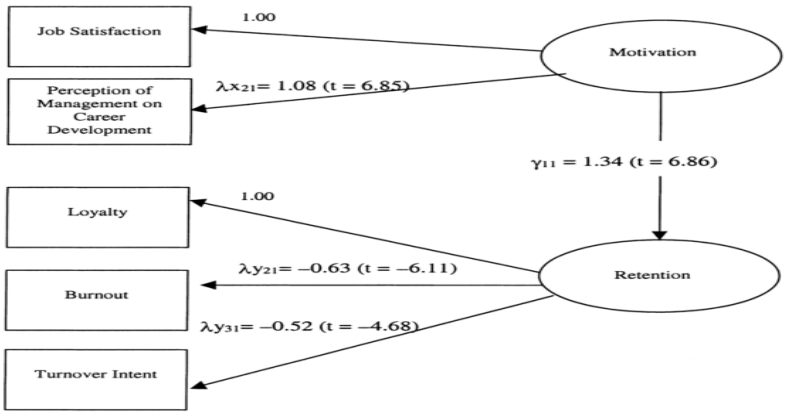


Figure 2.11 Mak and Sockel's Model (2001)

Following this, another social-based model was designed by Lee (2002). This model utilises social needs and interaction in improving employees' job satisfaction and hence, motivation levels. In this way, the turnover intention level should also be decreased accordingly (see Figure 2.12).

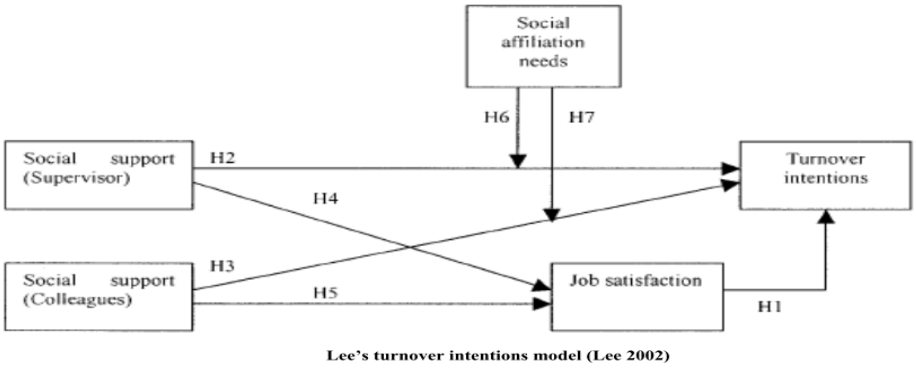


Figure 2.12 Lee's Turnover Intentions Model (2002)

Lee's study confirmed that job satisfaction plays a mediating role between social support and turnover intention. Furthermore, workplace support has a negative relationship with turnover intentions for computer professionals with high social affiliation needs.

Thirdly, Thatcher, Liu and Stepina (2002) showed that two hygiene factors (supervisor satisfaction and pay satisfaction) could practically affect job satisfaction and organisational commitment levels. However, there are also five intrinsic motivators (autonomy, task variety, task significance, task identity and feedback) that mediate this

relationship. They assume that all these factors might influence an employee's motivation intrinsically, and they assume that intrinsic motivation has a direct influence on employees' attitudes, such as commitment and job satisfaction, which consequently will have an impact on turnover intention (see Figure 2.13).

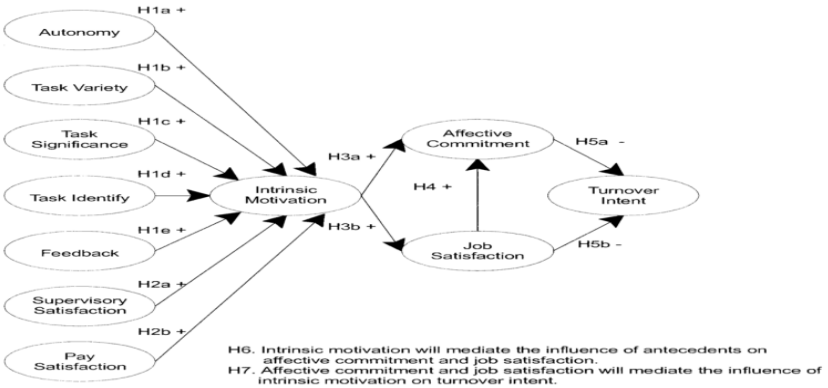


Figure 2.13 Thatcher, Liu and Stepina's Model (2002)

2.9.4 **Models Exploring the Relationship between Several Components**

These kinds of models focus on different elements and provide a cross-section through the models in different directions.

Firstly, two founding theories – Expectancy Theory (Vroom, 1964) and Goal-Setting Theory (Locke, 1968) were combined into an integrated model of motivation by Rasch and Tosi (1992). Their empirical results indicated the relationships shown in Figure 2.14. The number on the connector indicates the influence of one on the other.

Secondly, and similarly to the first model, Gambill, Clark and Wilkes (2000) designed an eight-variable model named the holistic task design model (Figure 2.15), in order to perfectly design a task for Information Systems' professionals.

Thirdly, Smits, McLean and Tanner (1997) combined Job Expectation Theory with Organisational Commitment level, in which employees take the path of searching for another job if they have not met the expected benefits of that job, and vice versa (Figure 2.16). Their model depicts the requirement for meeting individuals' needs through teamwork, contact with users and the opportunity to develop professional friendships (Sharp et al., 2009).

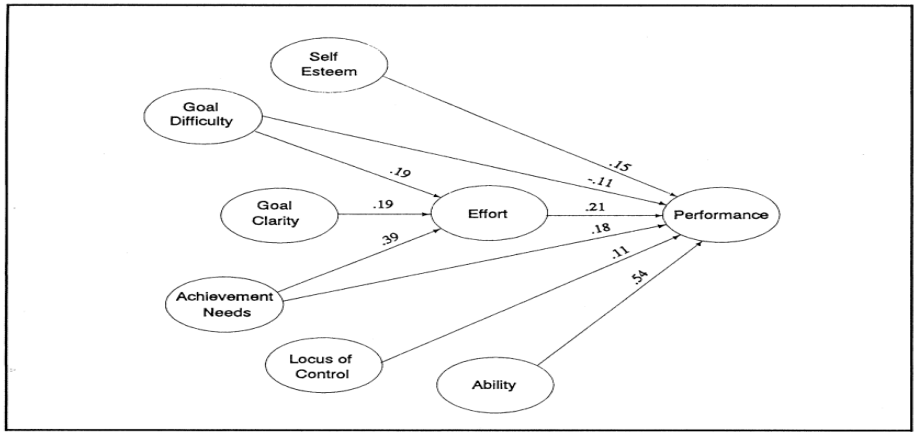


Figure 2.14 Rasch and Tosi's Model (1992)

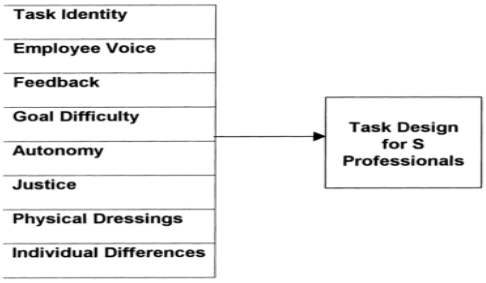


Figure 2.15 Gambill, Clark and Wilkes' Model (2000)

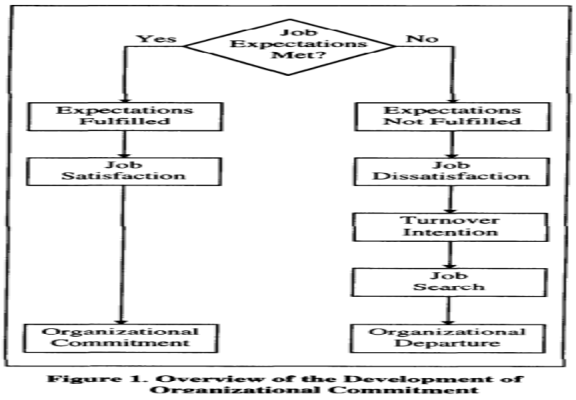


Figure 2.16 Smits, McLean and Tanner's Model (1997)

Finally, a more advanced model was introduced by Roberts et al. (2006). They tried to describe how motivation varies from one developer to another, based on their experiences and abilities in Open Source Software development (OSS). This model shows the relationships between motivation, participation and performance in open source software (OSS) development, as well as the effect of 'internalised extrinsic

motivators' on developers' participation and then performance. These internalised extrinsic motivators are:

- Use value: which is the desire to fix a bug or solve a problem of immediate relevance to the contributor.
- Status and opportunity motives: which is the degree of freedom of developers and opportunities to express their creativity and enjoy their work and experience.

They show how motivators vary across individuals and combine with individuals' knowledge, skills and abilities to produce task-relevant behaviours that contribute to individual performance. Over time, the OSS community will evaluate developer participation and then grade him or her up within the OSS community. Developers could also get valuable feedback for future work (Figure 2.17).

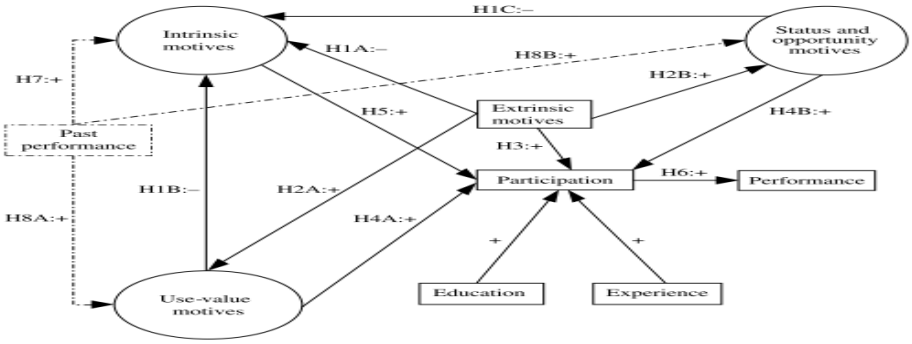


Figure 2.17 (Roberts, Hann, Slaughter, & Il-Horn's Model,(2006)

2.10 **Interpersonal Factors in Software Engineering**

Software engineering processes are considered human-centred processes. Hence, human factors have an enormous impact on the software engineering process and its performance, whether this impact is positive or negative. This could be explained by exploring the impact of human-based roles in the development process i.e. in terms of a developer affecting the software development phases, and a project manager having a noticeable impact on process performance and success. Human factors in software engineering could be unquantifiable and unpredictable, due to the complications in people's behaviour and intentions. This has been given much consideration in terms of the psychological, cognitive, management and technical aspects. According to data from the Software Engineering Institute, human resources constitute an average of 70% of the costs in a software engineering project (Franca & da Silva, 2009). Many problems that

may lead to project failure, for example software errors or the variability of requirements could be related to inefficiency in people management in the development process, and could be alleviated by adopting adequate practices in team management and interpersonal activities (Weinstein, 2014).

In software engineering, different interpersonal factors interact continuously with different types of practices in the workplace, such as team working, pair programming, cooperation, learning groups, training, evaluation and group innovation. Therefore, a high level of effort is needed in the workplace to facilitate this interaction through communication, collaboration and cooperation when people are performing in groups.

In this research, McClelland's Theory of Achievement was found to be the most relevant and descriptive theory that captures individuals' needs and interpersonal relationships in workplaces. Hence, this theory is tested in this research empirically.

McClelland's Theory of Achievement was tested among tourists by Ross, in 1997. A sample of 273 backpackers travelling in Australia were analysed. The significant findings of this study revealed that two need motivators were important to this type of tourist, the need for power, (which is described as environmental controllability) and achievement (Ross, 1997). The individuals in the study who had a high need for achievement also placed a high value on vacations, which may be more likely to be taken by people with higher levels of need achievement (Ross, 1997).

McClelland's Theory was also applied in educational environments by Moor, Grabsch and Rooter (2010) in order to examine student motives for participating in a residential leadership learning community for incoming freshmen. An open-ended question asked students what their primary motive was for participating in the voluntary activity. The results demonstrated that while all three needs were found in the responses, the need for achievement and the need for affiliation were more common motives for joining the leadership learning community (Moore et al., 2010).

In the field of sports and exercise, a study involving 52 males was conducted by Wegner et al. (2014) to investigate the predictive value of the explicit and implicit affiliation motive for social behaviour in sporting competitions. The results confirmed that the explicit affiliation motive was associated with time spent in verbal team contact,

whilst the implicit affiliation motive was linked to pleasant non-verbal behaviour shown toward opponents.(Wegner, Bohnacker, Mempel, Teubel, & Schüler, 2014)

In the financial sector, a study was conducted by Harrell and Stahl in 1984 to examine the ability of McClelland's Theory of Achievement to provide a conceptual explanation of the job satisfaction and work performance of professionals in Certified Public Accounting firms. The results suggested that McClelland's Theory of Achievement might provide a conceptual explanation of why some individuals experience relatively high job satisfaction levels in an environment where their counterparts experience relatively low level in their job satisfaction (Harrell & Stahl, 1984).

In software engineering environments, people are mostly organised in groups to achieve higher performance levels. Thus, a homogeneous group includes high achievers (Capretz, 2003; Couger & Zawacki, 1980). However, competence has a substantial impact on the ability to achieve goals, as some goals are attainable but the performer has less competence to perform, and hence achieving that goal would be impossible. There are two types of competencies in software engineering, technical competencies and personal competencies (Asproni, 2004). Technical competencies include the knowledge and skills required to achieve the team's goals, whilst personal competencies are the personal skills of the individual, plus the ability to work effectively in a team, which, in turn, will make the real difference in team performance (Asproni, 2004).

Achievement needs could be explained in the software development context in which different people are working on a common project, agree to common goals with a common view, share information, and mesh their activities, to construct the desired software, whether this software is part of a bigger system which is in place or an independent one. To build the software efficiently, they must coordinate their work so that it gets done and fits together (Kraut & Streeter, 1995). Couger found that software engineers have the highest achievement needs of any computer-related group previously surveyed (Couger, 1986).

A systematic review of the field of software engineering carried out by Sharp et al. (2009), revealed that software engineers have their own characteristics, needs and desires, as shown in Table 2.5. For example, the literature claims that a software engineer is introverted by nature but also has a need for variety in his/her work. (Sharp et al., 2009)

Table 2.5 Software Engineers' Characteristics and Needs (Sharp et al., 2009)

Software engineer characteristics	
Software engineers are:	And have a need for/to:
Growth-oriented	Variety
Introverted	Challenge
Autonomous	Identify with group
Achievement-oriented	Competent supervisors
Technically-competent	Feedback
Marketable	Contribute
Creative	Involvement in personal goal setting
	Stability (geographic and organisational

Individual motivation starts with the recognition of a desire that is hidden until the time the individual notices it, followed by a conscious desire to achieve certain goals in a particular manner (Kian, Fauziah, & Yusoff, 2012). According to (Kreitner & Kinicki, 2007), motivation is defined as a psychological process that continuously raises motivation, direction and voluntary actions towards achieving goals

2.11 **Occupational Factors in Software Engineer's Motivation**

Occupational factors refer to the conditions that are to be correlated to a particular job or professional requirements. Since software engineering has a different job structure and characteristics (Rehman et al., 2011), work conditions could be different from any other industries. These conditions could be observed through particular elements of software engineering practices, such as daily work type, contracting conditions and team members' roles in software engineering environments. Despite the fact that certain work circumstances could increase the motivation for some individuals, but could impede others from being highly motivated, the influence of all "or some" of these occupational conditions on the motivation level in software engineering has received little attention in the literature (Yang, 2011).

In an early study, Ferratt and Short (1986) found that IT employees within the technical-professional group were not more motivated by achievement needs than corresponding subgroups of non-IT employees, although they did find that meaningful work was the highest motivator for these IT subgroups (Ferratt & Short, 1986). However, although these finding were of interest in the software engineering motivation field, the environment for software engineering has changed considerably since that time by

introducing new development methodologies and techniques (Beecham, Baddoo, Hall, Robinson, & Sharp, 2008).

Based on the systematic literature reviews conducted by França & Gouveia (2011) and Sharp, Baddoo, Beecham, Hall, & Robinson (2009), several occupational factors have been shown to be important in software engineering environments, therefore they are considered as "Motivators", as presented, in descending order, in Table 2.6.

Table 2.6 Occupational motivators in software engineering (Baddoo & Beecham, 2008; França & Gouveia, 2011)

Motivators	**Frequency** No. of studies
Identify with the task	20
Good management	16
Career path	15
Variety of work	14
Recognition	12
Technically challenging work	11
Autonomy	9
Work/life balance	7
Empowerment/responsibility	6
Making a contribution/task significance	6
Appropriate working conditions/environment/good equipment/tools/physical space/quiet	6
Equity	3

For the scope of this research, further occupational factors are sought to be added to this list through the designed methodology, as variables in workplaces are changing over time (Sharp et al., 2009)

2.12 **Organisational Factors in Software Engineer's Motivation**

Organisations are made up of people, and people do not act like machines (Heyer, 2004), although this definition could be more precise and concise, organisations could be investigated through various 'lenses' such as strategy, culture, politics and behaviour. McConnell (1998) explains how it is difficult for the organisation to motivate its employees easily, although it is aware that motivation is essential to its

productivity level. Managers should understand their organisational difficulties if they want to be successful in leading the staff towards achieving the corporate objectives (Ahmad, Idris, & Hashim, 2013).

The importance of organisational factors could be seen primarily through the Capability Maturity Model (CMM), which is widely used to assess organisations' ability to perform their software process successfully in terms of an evolutionary path from ad hoc, chaotic processes to mature, disciplined software processes, and to provide guidance to improve their process capability.

The Capability Maturity Model (CMM) comes from the Software Engineering Institute (SEI) of Carnegie Mellon University as a result of conducting a significant research into several areas of business process improvement and reengineering.

Furthermore, according to the Software Engineering Institute at Carnegie Mellon College (2001), CMM has five levels of maturity, as follows:

1) Initial. The software processes are characterized as ad hoc, and occasionally even chaotic. Few processes are defined, and success depends on individual effort and heroics.
2) Repeatable. Basic management processes are established to track cost, schedule, and functionality. The necessary process discipline is in place to repeat earlier successes on projects with similar applications.
3) Defined. The software process for both management and engineering activities is documented, standardized, and integrated into a standard software process for the organization. All projects use an approved, tailored version of the organization's standard software process for developing and maintaining software.
4) Managed. Detailed measures of the software process and product quality are collected. Both the software process and products are quantitatively understood and controlled.
5) Optimizing. Continuous process improvement is enabled by quantitative feedback from the process and from piloting innovative ideas and technologies.

Predictability, effectiveness, and control of an organization's software processes are believed to improve as the organization moves up these five levels (Software Engineering Institute, 2001). These five levels are shown in Figure 2.18.

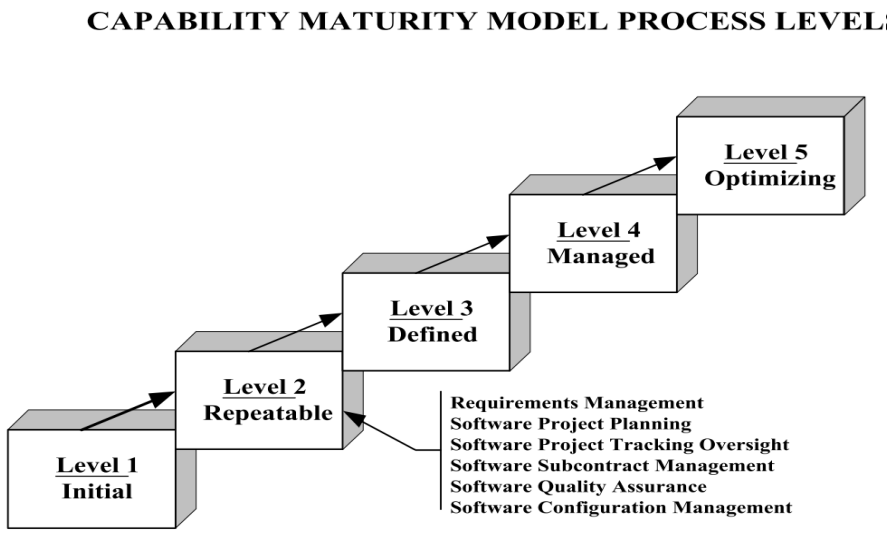


Figure 2.18 CMM levels (SEI,2001)

Each maturity level (except the first level) is decomposed into several Key Process Areas (KPA) that indicate the areas an organization should focus on to improve its software process.

At Level 2, KPA focuses on the software project's concerns related to establishing basic project management controls. They are Requirements Management, Software Project Planning, Software Project Tracking and Oversight, Software Subcontract Management, Software Quality Assurance, and Software Configuration Management.

At Level 3, KPA is concerned with both project and organizational issues, as the organization establishes an infrastructure that institutionalizes effective software engineering and management processes across all projects. They are Organization Process Focus, Organization Process Definition, Training Program, Integrated Software Management, Software Product Engineering, Intergroup Coordination, and Peer Reviews.

At Level 4, KPA establishes a quantitative understanding of both the software process and the software work products being built. They are Quantitative Process Management and Software Quality Management.

At Level 5, KPA covers the issues that both the organization and the projects must address to implement continual, measurable software process improvement. They are Defect Prevention, Technology Change Management, and Process Change Management (Software Engineering Institute, 2001).

Each Key Process Area is described in terms of the key practices that contribute to satisfying its goals. The key practices describe the infrastructure and activities that contribute most to the effective implementation and institutionalization of the key process area.

Each organisation has different needs and requirements for their software development process that relate to business and product development models, technology and people. Hence, it is difficult to compare two different organisations rigorously. Therefore, one of the most important roles of the organisations is to provide a framework for the teams to organise their work, and hence achieve the desired goals (Highsmith, 2009).

Organisational factors have been considered in a small number of the systematic literature reviews regarding motivation in software engineering. They are mentioned by Sharp et al. (2008), as those external factors that influence motivation characteristics in software engineering workplaces, including the type of the organisation and the level of stability (Beecham et al., 2008). Moreover, a sub-category was dedicated to such factors in another systematic literature review, conducted by Pirzadeh (2010). Furthermore, a study conducted to identify the factors that affect employee empowerment showed that the organisational conditions have a substantial impact on the empowerment process (Rastegar, Mahmoodian, & Alimadadi, 2013). In an earlier study, DeMattio et al. (1998) suggested that one of the most important issues that needs to be considered when designing team-based reward and recognition programmes was organisational characteristics (culture, structure and congruence), hence, motivation would be affected accordingly (DeMatteo, Eby, & Sundstrom, 1998) . According to Amar (2004), motivation mainly could be driven by the willingness of the organisation’s leaders to focus more on transforming their working environments to motivate their employees to engage in behaviour that is consistent with their goal (Amar, 2004). Working in a

successful company is suggested to be a motivator in two different studies in recent years (Garza, Lunce, 2003; Agarwal & Ferratt, 1998).

Furthermore, the prosperity in the industry and the economy worldwide has motivated many organisations towards adopting some changes in order to keep pace with the current competition and demands in the market, while many organisations still use old methods and procedures in guiding and monitoring their generationally diversified employees, including employment activities, operational processes, organisational procedures, evaluation criteria, appraisal methods and remuneration packages (Kian et al., 2012). In addition, Milne (2007) suggested that an organisational change was required by converting the dynamics of work from structure driven, that is, organised around individual roles and functions, to process driven and organised around teams, and urged that they should change the reward system accordingly, to support those new dynamics (Milne, 2007).

Previous research showed that most IS problems are non-technical in nature (i.e. social, conceptual, or organisational (Lyytinen & Robey, 1999). Among these problems are turnover intention (Zheng & Lamond, 2010), and poor organisational commitment (Ben-Bakr, Al-Shammari, Jefri, & Prasad, 1994; Kun, Hai-yan, & Lin-li, 2007; Leung & Chen, 2011; Tay, 2009). Nevertheless, organisational structure has a significant influence on the work conditions (Doherty, Champion, & Wang, 2010; Gilmour & Bourke, 2008; Jonker & Treur, 2003; Ledbetter, 2003; Miller, 1986) whether this influence is witnessed in software firms or not.

2.12.1 **Organisational Commitment**

Organisational commitment is defined as "the psychological attachment felt by the person towards the organisation. It reflects the degree to which the individual internalises or adopts characteristics or perspectives of the organisation" (O'Reilly & Chatman, 1986). Organisational commitment could be classified based on different theoretical purposes and perspectives. However, the most commonly accepted theory used in considering organisational commitment was introduced by Meyer and Allen in 1991, and this approach has been used in many organisational commitment studies (Coetzee, 2005; Coyle-Shapiro & Kessler, 2000; Johnson, 2005; Kraft, 2008; Leung & Chen, 2011; Shepherd & Mathews, 2000; Tay, 2009; Yin & Wu, 2009) . Mayer and Allen (1991) categorise commitment into three main themes:

1. Affective commitment could be attributed to the strong emotional relationship between an employee and their organisations. Employees with a strong affective commitment are likely to stay at their organisations longer than those without.
2. Continuance commitment refers to the cost estimation of leaving the current job and looking for another, 'better' position. It considers the time and effort required to build new skills and relationships, as well as other factors.
3. Normative commitment could occur by an employees' obligation to remain at an organisation due to issues such as responsibility and binding conditions such as family, culture or even the monetary rewarding system, for example, insurance, loans and housing (Meyer & Allen, 1991).

According to Smits et al. (1997), positive organisational commitment in Information Systems environments could be achieved by meeting workers' expectations on the job, and keeping the promises given to the workers by their employers.

2.12.2 **Organisational Structure**

Organisational structure refers to "the formal aspect of an organisation's functioning: division of labour; hierarchical authority; job descriptions" (Beynon-Davies, 2002). Therefore, relationships between employees and process and management could be shaped by the structure of their organisation. Moreover, the organisational structure has an impact on the choice, design and development of information systems (Al-halak, Al-karaghouli, Ghoneim, & Koufopoulos, 2010; Baxter & Sommerville, 2011; Beynon-Davies, 2002). The relationship between organisational structure and innovation performance in a large sample of UK small and medium-sized enterprises was observed by Cosh et al. (2012), who found that decentralised decision-making, supported by a formal structure and written plans, supports the ability to innovate (Cosh, Fu, & Hughes, 2012). Most organisations achieved limited success and many restructurings which involved considerable social costs and limited gains in effectiveness (McMillan, 2001). The interaction between Information Systems (IS) and organisational structure could be seen mutually from each side. The structure of a particular organisation could change IS design and, conversely, IS outcomes could change the structure of the adopted organisation. Doherty et al., (2010) state that the implementation of Enterprise Resource Planning technology (ERP) and the strategic orientation of the host organisation are both likely to modify the structural design. The study by Doherty et al. (2010) proves the impact of ERP on organisational structure, but conversely, organisational structure

could impede the development of software applications such as ERP (Chen, Chen, Wang, & Chu, 2009). According to Beynon-Davies (2002), three aspects should be taken into account before adopting a particular structure: (1) Division of labour (2) Chain of command and control (3) Specification of rules and procedures. Although these aspects are critical in practice, organisation size and policies might impede the choice of a particular structure. In bureaucratic organisations, these aspects could be witnessed clearly from an early time (Pugh, Hickson, Hinings, & Turner, 1968). Large organisations have shown a more rigid and constant structure by adopting a vertical hierarchy of command and information flow, in which the commands flow down the hierarchy while feedback, information and reports flow up the hierarchy. Many large organisations have changed their structures to a multi-divisional structure in order to cope with the vast development of competition. Furthermore, modern organisations have made more effort to give some units within many of their divisions more autonomy and trust in making their own decisions (Beynon-Davies, 2002).

From the perspective of project management, there are three main models of organisational structures: functional organisation, pure project structure (with dedicated project teams) and matrix organisation (Larson & Gray, 2011).

1. **Functional Organisational Structure** attempts to link each project directly to the associated functional department in the organisation. The functional department's staff are highly involved in the project's outcomes. Thus, the department head would take the role of project manager or team leader, even if his or her experience is not sufficient in some aspects of the project (Larson & Gray, 2011; McMillan, 2001; Moore, 2002).Moreover, each department might be involved in leading several projects at the same time, depending on the importance of this department.
2. **Pure Project Organisation** (also known as dedicated teams structure): In this type of structure, the organisation tries to create a new, exemplary, independent working environment that is supplied with efficient staff members and project managers in order to implement its projects with a high level of efficiency and professionalism (Larson & Gray, 2011). This model has many advantages in terms of the quality and level of autonomy, but some negative points have been reported, such as cost post-project transition and workers' internal strife. Accordingly, each department in the parent organisation needs to communicate

with the project team through one formal channel such as an allocated coordinator between these two environments.

3. **Matrix Structure** was defined by Ford and Randolph as "any organisation that employs a multiple command system that includes not only a multiple command structure but also related support mechanism and an associated organisational culture and behaviour pattern" (Ford & Randolph, 1992). A matrix structure tries to combine project organisation with the parent organisation in order to enable a project manager to control what is to be done by the individuals and groups assigned to each project while they are engaged in their daily tasks at their workplaces (Larson & Gray, 2011; Moore, 2002).

2.13 Summary of the Literature Review and the Research Gap

In this chapter, motivation theories were explored and explained briefly, as they are the ground of the model proposed in this thesis. The nature of software engineering professions has been explained, and the need for a tailored motivation model has been justified and presented.

Models in software engineering motivation fields have manifested the complexity of motivation and how motivation could be achieved from different components (França & Gouveia, 2011). In addition, the dynamic and changeable attitudes of people who work in software engineering have become an organisational challenge. The overlapping between different theories has been witnessed in different models in software engineering studies. Hence, by investigating the components presented in these models, a noticeable overlapping between three main groups of factors were found: organisational, occupational and interpersonal factors.

2.13.1 Research Gap

The gap in literature could be found at the following points:

1. The literature shows that previous research may not have sufficiently included theories of motivation and some recent variables when investigating motivation in software engineering. Although many motivational theories provide feasible theoretical frameworks for motivated behaviour, only a small number of studies have been carried out in the software engineering industry.

2. Most of the models that were presented in the literature treat motivation in only two degrees (cause-effect), for example (the influence of work tension on motivation), (the influence of job satisfaction on motivation), but more reasoning is essential to identify the primary sources of job dissatisfaction or work tension, therefore, another level of investigation is required.
3. Overlapping of three principal components (organisational, occupational and interpersonal) in software engineering environments was found to be an essential element in understanding the motivation and demotivation factors in the software engineering industry. For example, there are some differences in equity feeling levels amongst individuals from different roles and different types of jobs. This reflects the interaction between roles and personal equity sense. However, more investigation is needed to validate this result in the workplace.
4. Motivation factors are still challenging and changing over time. Therefore, further research is required to find out the most recent motivational factors in software engineering environments. These factors should be added to this study's theoretical model, and then validated empirically.
5. Most of the results from studies presented in this study were obtained a few years ago, and need to be updated, as these results could have been changed or influenced by the radical changes in the world economy or other external factors.
6. Expectancy Theory of motivation could provide a numerical measure of an individual's motivation in the workplace, therefore, using the concepts of this theory will provide a quantitative approach to measuring the motivation level in this study's sample, and could also be used as a metric of the application of the other motivational theories in software engineering environments.

Therefore, studying the influence of new factors in the light of some of the motivational theories could contribute to the understanding of the complex motivational factors in software engineering environment leading to developing a comprehensive model of motivation tailored for professionals working in software engineering.

Chapter 3. RESEARCH METHODOLOGY

3.1 Introduction

The last chapter reviewed the literature and previous studies and revealed the importance of motivation in software engineering, like other industries. The characteristics of software engineering professionals were explored in previous studies, and the need for a tailored motivation model has been reasoned and presented. This chapter discusses the problems and design of the research and also explores the quantitative and qualitative research methods considered for the collection and analysis of data. The selected research philosophy, methods, and techniques are discussed in detail.

3.2 The Research Problem

Fierce competition within the software development industry has increased significantly in recent years. This has raised the level of complexity not only in manufacturing software applications, but also in the management of individuals in these development settings, hence, managing the workforce resource has become challenging. The high level of expectation of the end users witnessed in IT projects has helped in re-shaping the way software projects have been developed worldwide. Hence, people have been seen as an indispensable component in all recent software development methodologies, such as Agile and Crystal (Cockburn & Highsmith, 2001). Furthermore, corporate needs and objectives have become more challenging, due to the problems in finding qualified technical IS people, and thus, there is noticeable competition for this limited resource (Ridings & Eder, 1999). As a result of this shortage, there has been a marked increase in software engineers' salaries particularly in the USA, reaching around $95,000 p.a. on average (Bureau_Labour_Statistics_USA, 2013). Moreover, as the rapidly changing business and technology environment develops, more efforts are needed in keeping technical software engineering personnel motivated, focused, and satisfied with their jobs (Ridings & Eder, 1999), leading to decreasing rates of intention for withdrawal from work (also known as turnover intention rates) (Smith & Speight, 2006). Motivation is seen as having the largest impact on the productivity of software engineering practitioners (Boehm, 1981). The quality of the software produced also

matches the motivation level, as motivation has a considerable role in software quality management (McConnell, 1998).

William F. Whyte in 1956 spoke of the 'Five M's of factory life: men, money, machines, morale and motivation (Wilensky, 1956). Over the years, the understanding of motivation has been shaped by the adoption of these "Five M's" as well as from several motivation theories. These theories provided business managers with different ways to motivate workers in different sectors. In particular, in the field of motivation in software engineering, these theories could be used as an underpinning foundation in order to understand the drivers of software engineering personnel, and hence, to motivate them appropriately. According to McConnell, "Motivation is a soft factor: it is difficult to quantify, and it often takes a back seat to other factors that might be less important but are easier to measure. Every organisation knows that motivation is important, but only a few organisations do anything about it. Many standard management practices are penny-wise and pound-foolish, trading huge losses in motivation and morale for minor methodology improvements or dubious budget savings" (McConnell, 1998). Models in the field of software engineering motivation have presented the complexity of motivation and how motivation could be achieved from different components (França & Gouveia, 2011). In addition, the dynamic and changeable attitudes of people who work in software engineering have become an organisational challenge. However, the findings from the literature show that previous research may not have sufficiently included theories of motivation and some recently emerging variables when investigating motivation in software engineering. The overlapping of three principal components (organisational, occupational and interpersonal factors) in software engineering environments was found to be an essential element in understanding the motivating and demotivating factors in the software engineering industry.

3.3 **Research Questions**

Based on the above research problem, the overall research question is:

- **What does an updated model of motivation in software engineering look like, taking into account the interaction between the three factors (interpersonal, occupation and organisation)?** (this question is answered in section 8.2 Multi-Factor Motivation Model's Development page 8-217)

This overarching research question covers the scope of this research, specifically investigating how these three groups of factors are identified and discussed by software engineering team members, and if the literature in this and other disciplines could help in understanding the complexity of motivation in software engineering. This is followed by investigating how these three groups of factors and their sub-factors could affect different aspects of software engineer's motivation.

Specifically, the focus of this research is the effect of a group of three high-level factors in software engineering environments on software development team members' intentions. The study takes an empirical approach, eliciting data from software development team members using several research methods, and at all times focuses on how software engineers need to be motivated and how to avoid de-motivating them.

The literature review has identified that there is insufficient comprehensive research investigating the influence of the three overlapping components in software engineering, and no study was found that focused solely on these three factors in software engineering. The literature review prompted the following three research questions (these questions are answered in (Chapter 8, section 8.12 Answers to the Research Questions page 8-228).

Q1. What is the influence of the interpersonal factors on software engineering's motivation level?

Q2. What is the influence of the occupational factors on software engineering's motivation level?

Q3. What is the influence of the organisational factors on software engineering's motivation level?

3.4 The Research Methodology

Research is a collection of skills, relatively independent of the need to resolve philosophical or epistemological debates, but it could nevertheless draw on these as resources for developing methodological knowledge (Seale, 1999).

3.4.1 The Research Philosophy

In general, research philosophy is linked to the way that knowledge is being developed by the researcher. Therefore, understanding the research philosophy is important because it is fundamental to how to address the study's questions. According to Mark

Easterby-Smith et al. (2002), an understanding of philosophical issues is very useful because it could help to clarify research designs, recognise which designs work best and to identify and adapt research designs according to the constraints of different subject or knowledge structures (Easterby-Smith, Thorpe, & Jackson, 2012). This study is concerned with the application of motivation tools, hence it is located within the paradigm of social science.

3.4.1.1 Research Epistemology

Epistemology is concerned with what is regarded as valid knowledge and the ways of acquiring knowledge. The key question that epistemology asks is 'What is acceptable knowledge?' Research epistemology involves three types of epistemological approach as following:

1. Positivism: this approach takes an objective view where researchers would be independent in this process.
2. Interpretivism: this approach involves the researcher's engagement and interaction in the research in order to understand the social world.
3. Pragmatism: this approach doesn't align with any one philosophical stance and recognises the importance of both the physical and social world. Pragmatist researchers focus on the 'what' and the 'how' of the research problem. Pragmatism is generally viewed as the most popular paradigm for mixed methods social enquiry (Greene, 2007).

Therefore, this research adopts the pragmatic approach by utilising the quantitative and qualitative approaches in acquiring answers to the research questions.

3.4.1.2 Research Ontology

Ontology is concerned with the nature of reality. In essence, it asks how we perceive the social world, or, to put it another way, the way we think the world is. The most common ontological approaches in research are subjectivism and objectivism.

Objectivism implies that social phenomena are based on external realities that are beyond our reach or control. Subjectivism is clearly linked to interpretivism, in that the researcher examines the motivation and social interactions of respondents. Therefore, in this study, the researcher has to understand the subjective beliefs and attitudes motivating respondents to act in a particular way.

3.4.2 The Research Approach

Research methods are often associated with two approaches, inductive and deductive. The inductive approach was defined by (Hyde, 2000) as 'a theory-building process, starting with observations of specific instances, and seeking to establish generalisation about the phenomenon under investigation'. In contrast, the deductive approach 'begins with and applies a well-known theory'. In other words, the research is applying theory rather than attempting to generate new theory through an inductive approach.

Deductive research is also seen as the opposite of inductive research in the way which results are expected to be found (Babbie, 2013). This approach is concerned with developing a hypothesis (or hypotheses) based on existing theory, and then designing a research strategy to test the hypothesis. 'In this type of research, theory, and hypotheses built on it, come first and influence the rest of the research process. This type of research is often associated with the quantitative type of research' (Ghauri & Grønhaug, 2005).

On the other hand, an inductive approach would involve collecting data and developing a theory as a result of the analysis of the collected data. This type of research is often associated with the qualitative type of research.

Based on addressing the gap in the literature identified in Chapter 2, it was decided to answer the research questions in this study by adopting both the deductive and inductive approaches, as explained in the following sections.

3.4.2.1 Deductive Approach

According to Walliman (2006), the decision on the appropriateness of analytical methods must be made in relation to the nature of the research problem and the specific aims of the research project. Quantitative data have distinguishing features in that they are measurable and testable by numbers rather than through textual interpretations. Although quantitative results could be more or less accurate, these results could reflect the levels of significance of the most noticeable phenomena in society (Walliman, 2006). Therefore, achieving the objectives of this study requires adopting a quantitative approach as the analytical method to answer the research questions (see page 3-62).

3.4.2.2 Inductive Approach

Bell stated that "The approach adopted and the methods of data collection selected will depend on the nature of the inquiry and the type of information required" (Bell, 2006). Investigating social phenomena that occur in the natural setting of real organisations rather than in an experimental setting requires an in-depth understanding of the experiences and views of participants (Pope & Mays, 2008). Qualitative data cannot be accurately measured and counted through large samples or the types of studies that require generalisability and wider applicability (Walliman, 2006). However, to obtain answers to critical questions regarding particular organisational issues, such as power conflicts, reporting relationships (including the delivery of requirements to IT departments and IT departments' reporting back on progress) and turnover intention rate within each organisation, requires an in-depth investigation to be carried out throughout several organisational settings to find out how the organisational factors influence the motivation of staff working in software engineering projects, and why. Therefore, it was decided to choose in-depth interviews to answer this study's questions.

3.4.3 The Research Strategy

The research design is broadly defined as involving exploratory research and conclusive research (Malhotra, Birks, & Hall, 2000). The main differences between these two forms of research design are shown in Table 3.1:

Table 3.1 Research design summary

Research project components	Exploratory research	Conclusive research
Research purpose	General: to generate insights about a situation	Specific: to verify insights and aid in selecting a course of action
Data needs	Vague	Clear
Data sources	Ill-defined	Well-defined
Data collection form	Open-ended, rough	Usually structured
Sample	Relatively small. Subjectively selected to maximise generalisation of insights	Relatively large. Objectively selected to permit generalisation of findings
Data collection	Flexible, no set procedure	Rigid, well-laid-out procedure
Data analysis	Informal, typically non-quantitative	Formal, typically quantitative
Inferences/recommendations	More tentative than final	More final than tentative

Regarding this research problem, the link between professionals' motivation and the software engineering environments has not been clearly defined. Exploratory research helps to determine the best research design, data collection method and selection of subjects, and sometimes it even concludes that the problem does not exist.

This research is to identify the primary sources of the motivation at professionals working software engineering, and then to develop a validated and updated motivational model. The aim and objectives of this research are based on two types of research, exploratory then confirmatory.

In the exploratory part, the problems that influence motivational power will be investigated through several sessions of in-depth interviews, as exploratory research will help to explore, understand and identify the precise problems involved, and assess the solutions. At the end of this part of the analysis, several factors are expected to have emerged.

In the confirmatory research part, the factors that emerged from the exploratory research will be tested deductively by adopting several motivational theories in software engineering environments. Hence, the following steps of empirical study will be followed:

1. Observation. This involves collecting and organising empirical facts to form a hypothesis.
2. Induction. This is the process of forming a hypothesis.
3. Deduction. This involves deducing consequences with newly gained empirical data.
4. Testing. This involves testing the hypothesis with new empirical data.
5. Evaluation. This involves performing an evaluation of the outcome of testing.

3.4.4 **The Research Methods**

Research methods are about organising research processes and activities, including the collection of data in ways that are most likely to achieve the research's primary aim (Easterby-Smith, Thorpe and Lowe, 2002). Research methods are classified into different types which are qualitative, quantitative and mixed research methods.

The aim and objectives of this research emphasise gathering two types of data in order to explain the motivational phenomena in software engineering and then develop a

validated model that helps IT managers to motivate their subordinates efficiently. These two types of data are related to these questions:

- What are latest motivational factors that influence practitioners in software engineering environments, and how can they be grouped into categories?
- How do these new factors (from the previous point) affect the practitioners' feelings, quantitatively, in the light of the theories of motivation?

In order to answer the first question, a qualitative approach was followed, with the answers including different types of data (text, numbers or documents). In this approach, participants from different software engineering environments engaged in in-depth interviews to clarify the current influential factors that affected them in the workplace.

In order to answer the second question, a quantitative approach was followed, as the answers were provided in a numerical form. Factors from the answer to the first question were tested in light of several motivational theories, as mentioned in the confirmatory approach, including Expectancy Theory, Equity Theory, Goal Setting Theory, Self-Determination Theory and Organisational Commitment Theory

Access to data in PhD research is a common problem for the postgraduate researchers, therefore this study conducted a preliminary study to collect information that would help in the interviews and questionnaire design (what can be asked, and what can't) in order to avoid the confidentiality issues and also to encourage the participants to give data and contribute positively to the interviews and questionnaire survey. The objective of the preliminary study was to test the applicability of the collected list of factors that resulted from the literature review and to investigate if there were any more potential factors that could be added.

3.4.5 **The Research Techniques And Design**

The logic that links the data collection and analysis to yield results and then a conclusion is the appropriate research design (Walliman, 2006).Therefore, drawing this research's conclusion relies primarily on the valid connection between the phases of this study, as shown in Table 3.2.

The research design is based on many issues, such as what the researcher intends, the nature of the research problem, and the fundamental knowledge that needs to be

obtained. The main priority is to ensure that the research maximises the chance of meeting its aim and objectives, and hence, answering this research questions accurately.

This research will follow the six-phase plan as shown below in order to achieve its aim and objectives:

Table 3.2 Research design

The aim of the research: **To develop an updated model to motivate professionals in software engineering environments, taking into account several factors from different sources;**			
Phase No.	**Aim of the phase aim**	**The research method**	**The research techniques**
Phase 1	1.To explore the concept of motivation 2. To explore motivation theories. 3.To explore motivation models in software engineering. 4.To study the influential factors mentioned in the literature.	**Qualitative**	**Literature Review**
Phase 2	1.To validate some motivational factors that emerged from the literature review. 2.To collect information that would help in the questionnaire design stage. 3.To establish relationships with organisations in the software engineering industry in order to encourage them to give data and contribute positively to the questionnaire survey and the validation stage 4.To investigate any more potential factors that should be added.	**Qualitative**	**Preliminary Study (qualitative interviews)**
Phase 3	1.To test three groups of factors (interpersonal, occupational and organisational) in the light of several motivational theories. 2. To examine the significant level of the factors affecting the motivational force. 3. To examine the correlations between several factors and motivational theories in software engineering.	**Quantitative**	**Questionnaire Survey** **Online and written copy**
Phase 4	1. To investigate the influence of the	**Qualitative**	**Qualitative Interviews**

	organisational structure on motivation in software engineering firms. 2. To compare the withdrawal intention between several organisations.		
Phase 5	General discussion and building the motivational model.		
Phase 6	Validating and testing the model.	**Qualitative**	**Evaluation Research**

As shown in Table 3.2, a six-phase plan has been designed to be followed, and each phase is followed by the relevant analysis to confirm and explore the main findings of each phase.

3.5 **Summary**

This chapter has discussed the problem and methodology of the research, and also explored the quantitative and qualitative research methods considered for the collection and analysis of data. The selected research philosophy and methods were discussed and found to be developed out of the philosophy of pragmatism. Two types of study were selected. The first type consists of confirmatory studies to confirm and to verify the results from testing several motivational theories in software engineering environments.

The second type consists of exploratory studies to be used in two places in this research:

- In the preliminary study to find out the most current factors that could affect the motivation of professionals working in software engineering environments.
- To examine the influence of the organisational structure on the motivation level of the staff who are working in software engineering firms.

The Mixed Research Approach method (quantitative and qualitative) was selected to be used to successfully meet the research aim and objectives in this study. The quantitative data will be used to provide the data required in terms of the confirmatory study while the qualitative data will be used to provide the data required in terms of the exploratory study.

The research methodology is designed within six phases; each phase is to be carried out in line with the research aim and objectives. Phase One (literature review) is to be conducted to gather background and knowledge about this research subject as a support

to justify the research problem, the direction of the research and the appropriate research approach. Phase Two (preliminary study) is to be conducted to gain an inside view of the research problem and then to help in establishing the appropriate research design. Phase Three (questionnaire survey) is to be conducted to collect the data needed to support the research direction. Phase Four (qualitative interviews) is to be conducted to explore different factors in the research problem in more detail and to collect data to help to solve the problem. In Phase Five (building the motivational model) the data is to be collected together to produce the developed solution, while in Phase Six (validating and testing the developed model) perceptions and feedback are to be obtained from several IT managers to test and validate the developed model.

Chapter 4. QUESTIONNAIRE SURVEY DESIGN AND RESULTS

4.1 Introduction

The previous chapter (Research Methodology) reviewed the current research methodology in research fields and then provided the most appropriate approaches to be adopted in this research based on this research's requirements and objectives. The selection of the most appropriate research methodology was discussed, with expanded justification for such selection.

Based on this research plan, the first phase of the research was accomplished through the literature review (Chapter 2), by presenting the most relevant motivational theories, and the models that were developed specifically for software engineering environments. This chapter reports on two phases (the second and third phases). The second phase of the research (the preliminary study) aimed to confirm the findings of the literature review in terms of the factors affecting the motivational force of professionals working in software engineering projects. This second phase was accomplished through qualitative interviews with eight IT professionals and resulted in the identification of several potential factors affecting motivation in software engineering. The aim of the third phase of the research (questionnaire survey), was to collect data to test several motivational theories, based on different independent factors in the workplace. For this purpose, a survey was designed and distributed.

The principal reason for the use of qualitative interviews was to investigate any possible new factors affecting motivational level in software engineering that was not mentioned and considered in previous studies. It was thus crucial to consult practitioners and expert personnel in the software engineering industry in order to verify the applicability of the identified factors and to add/remove factors as appropriate. Another principal reason for the use of a questionnaire survey was to capture the most relevant types of professionals (such as different roles and different positions), that affect or are affected by motivational tools and practices in software engineering. The purpose of this was to generalise the results from that sample to the population as a whole by drawing statistical conclusions (McQueen & Knussen, 2002).

Thus, given the intended purpose of the survey, as outlined previously, and in line with the pragmatic philosophical perspective explored in the research design and methodology chapter, the questionnaire survey utilised the knowledge of the sample population to gather descriptive quantitative data to guide the direction in which the intended model would be developed and constructed.

This chapter delves deeper into the preliminary study (eight initial interviews), data collection procedure, structure of the questionnaire survey, data analysis framework, and lastly presents the main results. In addition, the chapter includes information relating to the data required, where and how this data was secured, and the method of how the sample was selected.

4.2 **Research Scope And Required Data**

The scope of the research concerns on developing a conceptual model for motivation in software engineering environments. Previous literature reviews have identified some of these factors, but in separate models and studies (not in one correlated model) as suggested in this research. A list of 29 motivators in software engineering was provided by the systematic literature review conducted by França & Gouveia (2011) based on 53 relevant papers. However, motivation in software engineering is still changing and could be driven by different aspects. The results of the present study could be different from those previous studies, in terms of the level of significance, the factors and in the new elements that have been added in the questionnaire surveys.

According to the research problem (3.2 The Research Problem) most of the identified factors were covered in the review conducted by França & Gouveia (2011). This problem necessitates an updated model comprising a collection of factors from different sources that might affect the degree of motivation in software engineering environments.

The main purpose of the data required in phase two is to identify the most relevant data required for the subsequent phases. As in any data collection process this will depend on the factors that have emerged and been approved in this phase. This could be done by investigating the appropriateness of some of the 29 factors obtained from the literature review (Chapter 2: 2.8 Motivation in Software Engineering), and from the new factors derived from this phase.

A conclusive list of factors to be examined in the questionnaire survey needed to be collected before the design of the questionnaire could begin. This conclusive list was obtained through a preliminary study containing eight interviews conducted with different types of IT personals from three countries (Saudi Arabia, India and Jordan).

In phase three, this study should examine only the factors that emerged from phase two, hence; exploring the significance level of some factors in software engineering environments, which in turn emphasises the need for developing a new model to help IT managers in motivating their staff in the workplace. This phase is an important step towards the development of a conceptual model for motivation in software engineering.

4.3 **Preliminary Study**

The aim of the preliminary study was to collect information that would help in the questionnaire design stage and any further data collection required. Also, this phase sought to build good networking and relationships with the software engineering firms in order to obtain their support for collecting and validating this research data.

The objectives of this stage were to examine the most influential factors obtained from the literature review (see Table 2.2 P 2-36 and Table 2.4 P 2-38) and to investigate any more potential factors that should be added.

The qualitative interview method was used as a method of investigation, in particular semi-structured interviews. The researcher used this type of semi-structured interviews to allow the interviewees to explore the topic from as many angles as they wished, and because it was more likely to result in producing information that the interviewer would not have expected. This stage of the research aimed at exploring the factors affecting the motivational process, and then to helping in developing the initial model of this study.

The interviews were conducted with professionals from different organisations and with different roles in software engineering projects (3 IT project managers, 3 developers, 1 system analyst and 1 team coordinator). All of them were men. The idea was to have this variety of roles in the preliminary study to obtain their points of view on the factors that they regarded as important regarding motivation in software engineering environments from different angles, and also to have their initial feedback on the factors collected from the literature review.

4.3.1 The Interview Context (data required) and Administration

It was planned to use semi-structured interviews, as recording the conversation is more elaborate regarding the factors affecting the motivation process. All interviews were audio-taped and then transcribed into a written form for analysis.

The first objective of the interviews was to gather information about the new factors associated with software engineering environments from the interviewees. The second objective of the interviews was to have feedback on the factors collected from the previous stage (literature review).

The interview sessions took place in Saudi Arabia and lasted for a three week period. Saudi Arabia was chosen particularly because of the official formal permission that was given to this research, and for the extensive software engineering industry there. In addition, this study's researcher had contacts with several project managers and team leaders in software engineering. The interview sessions were in a one-one form and were held in different places. The language spoken was Arabic based on the interviewees' preferences.

An interview form was prepared for these interviews. This form consists of two parts:

1. Part one, open-ended questions, which were recorded on an audio recording device.
2. Part two, list of factors evaluation table.

4.3.2 Interview Questions

In the interview sessions, the researcher opened the discussion with general questions and then tried to track and ask for more clarification if required. The researcher took notes on each interview and followed up useful points that were raised.

The questions were:

- **What motivates you (and your staff, if the participant is a project manager)?**
- **Do you think that people can be motivated differently? If YES please say why?**
- **What makes you de-motivated?**

- **To what extent do think these factors are important in motivating people in software engineering environments? Rate as the following:**
  (3 Important - 2 Neutral -1 Not Important - 0 I don't know)

These factors where obtained from the literature review as shown in Table 2.2 page 2-36 and Table 2.4 page 2-38. A copy of the interviews questions is shown in Appendix (B).

4.3.3 **Interviews Analysis**

Analysing qualitative data requires more effort and skill from the researcher as the context, people and interaction between people and the phenomenon investigated needs to be understood. Qualitative research seeks to understand a particular phenomenon from the perspective of those experiencing it. Therefore, the researcher needs to determine which research approach can answer the research questions (Streubert Speziale & Carpenter, 2007). In this regard, several tools and techniques were used for this purpose. The Content Analysis approach was one of those tools.

Content analysis is a procedure for organising narrative and qualitative data into emerging themes and concepts. Usually associated with a quantitative form of analysis in which the themes etc. are counted or measured. In practice, it is often combined with qualitative thematic analysis to produce a broadly interpretive approach in which quotations as well as numerical counts are used to summarize important facets of the analysis (Gibbs, Clarke, Taylor, Silver, & Lewins, 2011). It is a systematic coding and categorizing approach used for exploring large amounts of textual information unobtrusively to determine trends and patterns of words used, their frequency, their relationships, and the structures and discourses of communication (Pope & Mays, 2008).

Generally, there two types of Content Analysis (Mayring, 2000):

- Conceptual Analysis. Analysing the existence and frequency of concepts in human communication.
- Relational Analysis. Analysing the relationship between concepts in human communication.

In this research, Conceptual Analysis has been used in order to identify the most dominant motivators in software engineering environments.

4.3.4 Interviews Results and Findings

The Interviews started with three open-ended questions as mentioned above, then an evaluation process was conducted of the motivation factors obtained from reviewing the literature.

The most emergent themes and important points were noticed and discussed in further with participants. A copy of the summary of interview transcripts is shown in Appendix (C).

The main conclusion from the eight interviews was that it was clear that they agreed that there were other potential factors affecting motivation in software engineering environments.

4.3.4.1 Audio-taping Transcription

All the interviews were audio-taped in the Arabic language because of the interest of the interviewees. A small recording machine was used after obtaining the permission from the interviewee to be recorded.

The transcription process was based on recording the notes from each interview and summarising the interview. There were many replies that weren't related to the questions asked. A copy of the interview transcript is shown in Appendix (D).

4.3.4.2 Answering Interview Questions

In the first question, different motivation tools were preferred from one interviewee to another. For example, IT managers spoke about training and achievement of project goals while developers mentioned the monetary incentives and feeling of equality. Hence, some difference was observed based on their positions in the project.

In the second question, they all agreed that people were different in terms of their highest motivator. Some of them required development, while others preferred financial incentives. However, the reason behind these differences was discussed, and hence, attributed to their personal needs and desires. In addition, they believed that the motivation processes were influenced by different factors such as management styles, organisational structure and the roles played in software engineering projects.

In the third question, interviewees were asked about de-motivation. Most of their answers were related to the work itself such as clarity of tasks, projects size and communication and team working.

In the fourth question, interviewees were given a list of factors (obtained from literature review), and were asked to evaluate their importance. The aim of this question was to ascertain if there were any significant differences amongst the eight interviewees.

4.3.4.3 Variables Clarification

The variables sought in these interview sessions were any concepts that could influence the motivation level at the workplace, whether this influence had a positive or negative impact.

During the interviews sessions, 10 themes and concepts emerged explicitly throughout the conversations. These themes have been defined as the following:

Table 4.1 Themes definitions

Theme	Definition
Contracting	Any issues related to type of employment contract, renewal, finding another job.
Commitment and turnover	Any issues related to leaving the organisation such as feelings of belongingness, relatedness.
Working type and environments	Any issues related to the work style, meaning working in projects or working in operational routine jobs.
Job and roles	Any issues related to the differences between the participants in terms of their daily roles such as a developer, a coordinator, a Database Administrator, a project manager or a consultant.
Financial support	Any issues related to the monetary incentives.
Personal desires	Issues related to personal desires such as family circumstances and personal future plans.
Equality in workplace	Issues related to the feeling of being treated unequally compared to other people in the workplace.
Tasks clarity	Issues related to the clarity of the required job to be done.

Citizenship	Issues related to the feeling of injustice because of your nationality, or because you are an expatriate.
Age	Issues related to the differences in age, generation or maturity.
Organisational structure and authority	Issues related to the role of the organisational structure in getting work delayed, or causing a conflict.

4.3.4.4 Themes and Concepts Coding

The defined themes (in Table 4.1) have been coded and counted as shown in Table 4.2:

Table 4.2 Themes coding and frequency

No	Theme/ concept	Interviewees								Freq
		1	2	3	4	5	6	7	8	
1	Contracting	√	√		√	√		√		5
2	Commitment and turnover		√		√	√			√	4
3	Working type and environments	√		√	√			√		4
4	Job and roles	√	√	√		√	√			5
5	Financial support		√		√	√	√	√	√	6
6	Personal desires			√		√				2
7	Equality in workplace				√		√		√	3
8	Tasks clarity		√	√	√	√		√		5
9	Citizenship	√	√			√			√	4
10	Age		√					√		2
11	Organisational structure and authority				√	√	√			3

As presented in Table 4.2 , it has become clear that financial issues is the main factor that could influence an individual's motivation in software engineering environments, with 6 positive replies amongst a small sample of 8 people, which is considerably

significant in this regard. However, investigating other factors might reveal more interesting results. There are other concepts and factors that were discussed briefly in these interviews although they were previously introduced in the literature review, such as communication and coordination. However, these factors were added to the final version of this research model as shown in Chapter 8 page 8-220.

4.3.4.5 Concepts Mapping

Analysing the interviews transcriptions has revealed some logical association between the emergent concepts and themes.

The conclusions from these interviews were that the researcher must consider how motivation is influenced by the new factors. The interviews resulted in adding several potentially correlated factors, as shown in Table 4.3:

Table 4.3 Factors added to this study's model

No	New Factor (independent)	Affected factors (dependent variable)	Comments
1	Team member role	Receiving monetary incentives, recognition and equity.	Based on three roles explored: IT managers, technicians and coordinators.
2	Contract type	Commitment, turnover, willingness to work, personal needs.	Based on different types of contracts such as annual, projects, governments, etc.
3	Daily work types	Organising work objectives, willingness to work.	Based on two types of work: operation-based, project-based.
4	Organisational structure	Turnover intention, project closure, feeling of failure and conflict.	Based on three types of IT project structure: functional, matrix and dedicated teams.
5	Communication and coordination	Feeling informed with feedback, intrinsic motivation, challenges.	Inappropriateness in selecting the communication tools was an issue.
6	Psychological contract with	Commitment, career development.	The implicit contract between the employee and the employer.

	manager		
7	Age	Willingness, commitment.	
8	Citizenship	Commitment, equity feeling, intrinsic motivation.	Based on two types: working in their countries and expatriates.

As shown in Table 4.3, some of these factors are entirely new to the software engineering studies field, such as the team member role, the contract type, the daily nature of work, and the organisational structure. While some of them such as citizenship and age group, have been studied in different fields or with small sample sizes, studying these types of factors might contribute to the knowledge in software engineering.

Factors from Table 4.3 could be classified in this research into three groups:

A. Interpersonal factors, since they are dealing with interpersonal issues such as personal needs.
B. Occupational factors group, as these factors have a stronger level of relations with the job. These factors are:

- Daily nature of the work which refers to the operations or projects the software engineer is involved in.
- Member role (Technical, IT manager or coordinators).
- Goal-Setting Theory factors (Commitment towards goals, feedback and task clarity).
- Equity Theory factors in the workplace (Financial Equity and Recognition Equity).
- Turnover intention.
- Contract types (permanent, project-based, annual-based, private business and unpaid workers).

C. Organisational factors group which are concerned with higher level issues such as organisational structure and organisational commitment.

Accordingly, by combining these factors in one conceptual framework, a suggested graphical model could initially illustrate the interaction between these factors as shown in Figure 4.1.

Figure 4.1 Graphical model of the research

Based on the new factors that were added in Table 4.3, the suggested model in this study is shown in Figure 4.2. However, this conceptual model needs to be validated and tested empirically, as shown in Chapter 7:

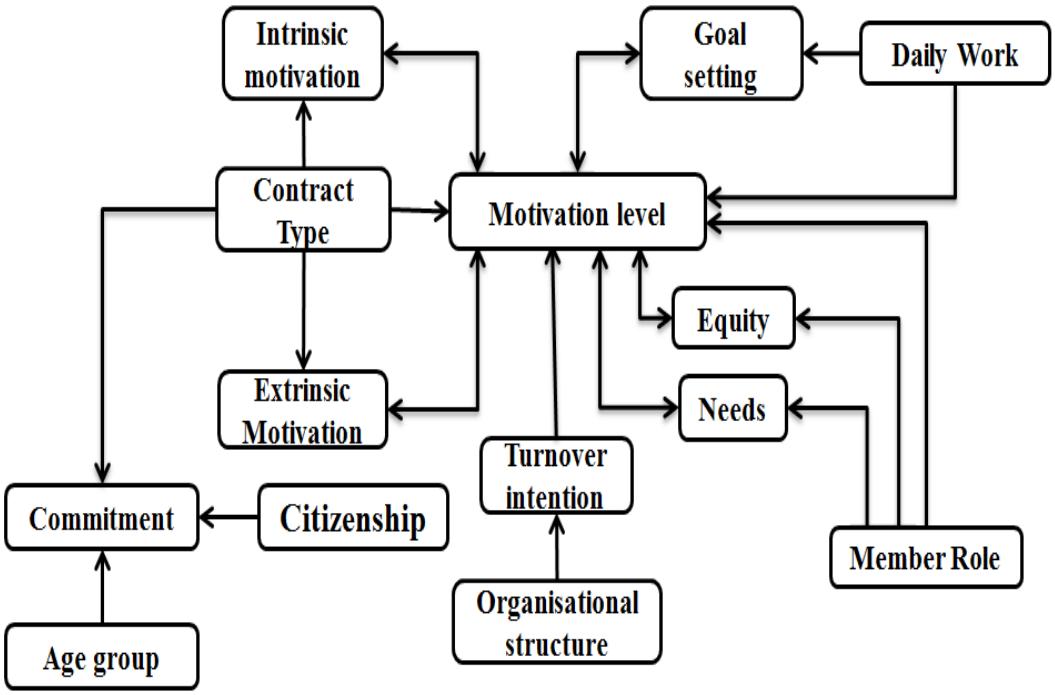


Figure 4.2 Initial model of the research

From the proposed model, as shown in Figure 4.2, it can be seen that different types of factors are influencing each other in different directions. The interactions between these groups of factors are tested empirically, and the results are validated statistically.

Accordingly, the researcher felt assured that there was a strong need to design a model that gives reasons for the recommended factors, as that would provide a rationale for explaining increased motivational levels of some employees in software engineering environments, and the decreased level in others. Based on the new variables, it was decided that two types of data collection would be conducted as follows:

1. Deductive (quantitative) approach. Designing a survey and testing the new factors (except the organisational structure factor) in the light of some motivational theories to answer these research questions.
2. Inductive (qualitative): An approach to test the influence of the organisational structure factor in software engineering environments and how this factor could cause the turnover intention to increase.

In summary, this research investigated the effect of several independent factors, such as team members' role, contract types, age, work location and work type on professionals' motivational levels in software engineering in the light of several motivational theories including Expectancy Theory, McClelland's Theory, Self-Determination Theory, Equity Theory, Organisational Commitment and Goal Setting Theory. Therefore, the questionnaire was designed as a cross-sectional survey, collecting data at one point in time for a self-selected sample of software engineering professionals.

4.4 Emergent Research Questions and Hypotheses

The emerged new factors has helped in expanding these research questions and working framework by adding new research questions that needed to be answered to reach the validated answer of the main research question.

The concept of Expectancy Theory was adopted to evaluate and monitor the Motivational Force value. Expectancy Theory provides a quantitative approach to measuring the Motivational Force (MF) for individuals by multiplying their Instrumentality, Expectancy and Valence levels (MF= I * E * V). The literature review on software engineering motivation found an insufficient number of studies covering

the interaction between particular occupational variables and the level of the Motivational Force (MF).

Interpersonal factors that have an impact on members' motivation in software engineering teams were explored based on the existing literature, and McClelland's Theory of Achievement's factors (achievement, power and control) was explored in the literature. Hence additional questions emerged in this study as follows:

Q4. What is the association between achievement, power and affiliation needs and the motivational force value of software engineering professionals?

Q5. What is the influence of the team member's role on the level of three needs (achievement, power and affiliation) in software engineering environments?

Occupational factors were investigated, by examining the influence of job-based factors from a wide range of literature, and from this, new questions were raised related to the occupational factors, which needed to be added to this research's area of interest. These questions are:

Q6. In light of Equity Theory, what is the influence of a software development team member's role in their feeling of Equity and the Motivational Force level?

Q7. In light of Goal Setting Theory, what is the influence of the nature of daily work on the applicability of goal setting and level of the Motivational Force?

Q8. In light of Intrinsic and Extrinsic Motivation Theory, what is the influence of contract types on the level of software engineers' intrinsic and extrinsic motivation and on their level of the Motivational Force?

Organisational factors were investigated through the literature from organisational studies and this uncovered the influence of many factors on software engineering environments. For the scope of this research, two important factors were chosen in this study as they were not sufficiently covered in the literature reviewed. These two factors are organisational structure and organisational commitment. Accordingly, the following research questions were asked and added to the scope of this study:

Q9. What is the influence of contractual conditions on the organisational commitment level of professionals in software engineering environments?

Q10. What is the influence of age group on the organisational commitment level of professionals in software engineering environments?

Q11. What is the impact of citizenship status on the organisational commitment level of professionals in software engineering environments?

Q12. What is the influence of organisational structure on software development processes?

Q13. What is the influence of organisational structure on turnover intention in software engineering environments?

These research questions were answered in Chapter 8 section 8.12.Answers to the Research Questions page 8-228 .

Accordingly, more detailed hypotheses were developed in order to answer the research questions as follows: *(these hypotheses are tested in five stages in Chapter 5, as each theory was tested separately, pages 5-123, 5-130, 5-136, 5-142 and 5-154).*

* * Hypotheses are numbered based on (H.X.Y) form, where (H: Hypothesis, X: The group A,B or C. Y: the sequence number of the hypothesis ,1,2,3…)

A. Interpersonal factors' group:

H.A.1. Individuals working in software engineering have a different satisfaction level for each of the three types of needs (achievement, control and affiliation), based on the role that they are playing in the projects.

H.A.2. The level of Achievement Need factor is correlated statistically with the Motivation Force level in software engineering environments.

H.A.3. The power and need factor is correlated statistically with the Motivation Force level in software engineering environments.

H.A.4. The fulfilment in affiliation need factor is correlated statistically with the Motivation Force level in software engineering environments.

B. Occupational factors' group:

H.B.1. The Equity Theory element (Recognition Equity and Financial Equity) could be influenced by the role of members in software engineering projects.

H.B.2. The Equity Theory element (Recognition Equity and Financial Equity) are correlated to the level of motivational force for software engineering professionals.

H.B.3. Goal-Setting Theory element (task clarity, commitment towards goals and receiving feedback) could be influenced by the type of the daily work of professionals working in software engineering environments.

H.B.4. Goal-Setting Theory element (task clarity, commitment towards goals and receiving feedback) are correlated with the level of motivational force for software engineering professionals.

H.B.5. The type of employment contract could predict the level of motivational force of software engineering professionals.

H.B.6. Intrinsic motivation could be influenced by the type of employment contract in software engineering environments.

H.B.7. Extrinsic motivation could be influenced by the type of employment contract in software engineering environments.

H.B.8. Intrinsic motivation is correlated with the level of motivational force for software engineering professionals.

H.B.9. Extrinsic motivation is correlated with the level motivational force for software engineering professionals.

C. <u>Organisational factors' group:</u>

H.C.1. Contract types have an impact on the three components of the Organisational Commitment (Affective, Normative and Continuance) in software engineering environments.

H.C.2. Age groups have an impact on the three components of the Organisational Commitment (Affective, Normative and Continuance) in software engineering environments.

H.C.3. Citizenship status has an impact on the three components of the Organisational Commitment (Affective, Normative and Continuance) in software engineering environments.

H.C.4. Organisational commitment is correlated with the Motivational Force level for individuals working in software engineering environments.

In (Chapter 7 DISCUSSION AND DEVELOPMENT OF THE MODEL), the findings of this research and the results from testing the hypotheses were combined with relevant theories of motivation that identify each factor as an influential factor in software engineering motivation. A validated high level integral Model of Motivation in software engineering was developed, which brought together all of the relevant findings from this research findings and relevant literature to identify a high-level model of motivation in software engineering, thus addressing the research's main question.

4.5 Questionnaire Survey and Data Collection

4.5.1 Survey Process

The software engineering industry was targeted in this study, as the primary model of this research concerning software engineering environments. Two types of surveys were designed, a web-based one and a written counterpart copy. Web-based survey invitations were sent by email to 1105 individuals working in the software engineering industry. Their emails were obtained through different channels such as Facebook, LinkedIn, Twitter, Freenlancer.com, PeoplePerHour.com and personal networking efforts. 208 responses were gathered in a period of three months.

The administration of the written copy of this survey was carried out in Saudi Arabia by the researcher. Several steps were taken prior to the responses being gathered. These steps in sequence were:

1) Obtaining official permission from the Ministry of Education in Saudi Arabia to sponsor this data collection.
2) Obtaining official permission from Heriot-Watt University.
3) Applying for a data collection trip permission through the Saudi Embassy in London.
4) Flying to Saudi Arabia within the agreed time limit and period.

The use of an online survey enables the collection of data from multiple participants without requiring direct contact. However, a hand-distributed survey could attract a higher response rate.

The survey was designed with the goal of collecting the desired data in a time-span of roughly ten minutes, to help encourage a larger number of participants.

4.5.2 **Survey Design**

According to (Fink, 2003), "surveys are systems for collecting information from or about people to describe, compare, or explain their knowledge, attitudes, and behaviour." Robson defines a survey as a "collection of standardized information from a particular population, or some sample from one, usually, but not necessarily, by means of a questionnaire or interview" (Robson, 2002). Oppenheim states that a self-administered questionnaire can ensure "a high response rate, accurate sampling and a minimum of interviewer bias" (Oppenheim, 1992).

In this survey, six different motivational theories were combined in order to answer the research's main questions and helped to develop an updated motivational model that suits individuals in software engineering. These theories are well-known and commonly tested in diversity of fields. These theories are: Expectancy Theory, McClelland Motivational Theory, Equity Theory, Goal-Setting Theory, Self-Determination-Theory and Organisational Commitment Theory.

The survey was designed using two languages, Arabic and English, in simple words to be understood intuitively, without confusion with any other terms, as suggested by (Fowler, 1995).

De Vaus (2002) recommended several good practices for survey design and these were followed in this procedure:

- Remove ambiguity.
- Avoid direct questions on sensitive topics (in interview situations).
- Ensure each question's frame of reference is clear.
- Avoid creating opinions.
- Use personal wording if you want the respondents' own feelings, etc.
- Avoid unnecessary or objectionable detail.
- Avoid questions with unclear alternative answers.
- Avoid producing set responses (De Vaus, 2002).

Three guidelines were suggested by Robson (2002: 190) in order to increase the acceptability of a survey and thus, increase the response rate to a remotely administered questionnaire. These guidelines are:

- The appearance of the questionnaire.
- The clarity of wording and simplicity of the design.
- The arrangement of contents to maximise co-operation.

Oppenheim (2000: 104) recommended these further steps to increase response rates:

- Providing advanced warning.
- Explaining how the respondent came to be chosen.
- Gaining sponsorship by someone expected to be influential to the respondents.
- Providing incentives for participation.
- Treating data confidentially.

When designing the survey, these guidelines were followed carefully, particularly the clarity of language used and arrangement of questions, in order to improve the response rate of the online survey as well as the written copy. Participants were invited, whether by email or in person, their selection explained, sponsorship by influential parties sought, and assurances of confidentiality provided.

The survey adhered to 5 further elements of good practice when designing online surveys:

1. The online survey was designed and tested to support multiple platforms and browsers (Yun & Trumbo, 2000).
2. Multiple submissions from the same user were limited (Pitkow & Kehoe, 1996).
3. Participant's answers were saved on multiple occasions (C. B. Smith, 1997).
4. Participants were given the ability to provide both closed and open-ended responses to questions (Yun and Trumbo, 2000).
5. Immediate "thank you" feedback was provided upon the completion of the survey (Smith, 1997).

In order to achieve the optimal design for the survey, a survey services provider (SurveyMonkey.com) was contracted with a Pre-paid Plan in order to provide better design templates and flexibility in reports and data gathering.

The survey (online and written copy) was structured in 9 pages, as shown in Table 4.4.

Table 4.4 Survey structure

Page	Content
Page 1	Introduction to the research, the topic of the survey, the format and questions included in the survey, and contact details should the participant have any further questions.
Page 2	Demographic information.
Page 3	Testing the Motivational Force (Expectancy Theory)
Page 4	Testing McClelland Motivational Theory
Page 5	Testing Equity Theory
Page 6	Testing Goal-Setting Theory
Page 7	Testing Self-Determination-Theory
Page 8	Testing Organisational Commitment Theory
Page 9	Thank you page

As shown in Table 4.4, the questions were distributed over nine pages, each page concerned with a particular target. A copy of the online and written survey, as designed, can be seen in the Appendix (A).

From Page 3 to Page 8, six motivational theories were tested in the software engineering context. The respondents' views were measured in a Likert response scale (Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree). More information about the source of these measures is given below.

4.5.2.1 Demographic Data

The demographic questions **asked in Page 2** are shown in Table 4.5, together with the possible responses and the type of responses next to each question. It should be noted that if a participant selected 'other', a free-text box would appear directly below the selected question for the participant to enter an alternative response.

Table 4.5 Demographical questions (Survey Page 2)

	Question	Response Options	Response Type
1	Gender	• Male • Female	Single-choice Radio Buttons
2	What is your age group?	1. Younger than 18 2. 18 - 24 3. 25 – 34 4. 35 – 44 5. 45 – 54 6. 55 – 64 7. 65 or older	Single-choice Radio Buttons
3	What is the highest level of education you have achieved?	1. Diploma. 2. Bachelor degree. 3. Master degree. 4. PHD degree. Other …….	Single-choice Radio Buttons
4	Which of the following categories best describes your job? (Member role)	1. IS technical (developers, networking, designers, tester .etc.) 2. IT project managers. 3. Administration work inside IS dept. (dept. manager, subordinates, call centre, help desk). 4. Administrative work outside IS dept.	Single-choice Radio Buttons
5	What is your employment status? (Contract type)	1. Government permanent job. 2. Annual-based Contract. 3. Project-based contract. 4. Unpaid workers Other …….	Single-choice Radio Buttons
6	What is your current daily work you are doing now? (Daily work)	1. Operations and daily work. 2. Project member. 3. Both (Projects+ operations).	Single-choice Radio Buttons
7	What is your work location?	1. I work in my original country. 2. I work outside my original country.	Single-choice Radio Buttons

Note: this survey design reflects Saudi Arabian male culture and working regulations, as stated in this research scope and limitations page 1-3.

From Questions 1 to 7, demographic answers were gathered which could contribute to the study's findings. In Question 4, particularly, software engineering jobs were divided into four categories (technical, management, subordinates and non-IT-related jobs), this

categorisation was based on the nature of each role, since people within the same groups are likely to have similar attitudes to their jobs. Technical workers were mostly performing on software development, on networks or on databases (computer-based tasks), whereas project managers have different challenges and missions. Responses from participants who selected number 4 (non-IT related jobs) were ignored altogether, as they are out of the study sample design.

4.5.2.2 Expectancy Theory Measurement

On Page 3, Expectancy Theory is tested by designing new items driven from the theory's concepts and application, as coined by (Vroom, 1964), this theory was also used recently to evaluate workers' performance in the public sector in Romania (Suciu et al., 2013) and showed the validity of this measure. However, a further validation step on this measure was performed in the analysis part of this research. Based on Expectancy Theory, motivation (M) is determined by three factors: expectancy (E), instrumentality (I) and valence (V), and could be computed by the following formula ($M= E \times I \times V$). Therefore, the questions based on this theory were designed as shown in Table 4.6: each question was linked with the particular factor that it was designed to measure.

Table 4.6 Expectancy Theory Measure (Survey Page 3)

	Question	Factor
8	The nature of the work assigned to me is reasonable.	(Motivational Force) Expectancy
9	I can do everything I am asked to do.	(Motivational Force) Expectancy
10	I work at the required performance level in my organisations.	(Motivational Force) Expectancy
11	I am deeply involved in my current job.	(Motivational Force) Expectancy
12	I believe that my current work will end up with successful results.	(Motivational Force) Instrumentality
13	I trust my supervisor in all his promises.	(Motivational Force) Instrumentality
14	The delivered salary is worth the expenditure of time and effort.	(Motivational Force)Valence
15	The official support is sufficient.	(Motivational Force)Valence

As shown in Table 4.6, in Questions 8 to 15, the level of motivational force for each participant has been measured. Hence, Questions 8, 9, 10 and 11 were dedicated to measuring the Expectancy factor in the Motivational Force equation, in which each individual is capable and willing to do his job. Similarly, Questions 12 and 13 try to measure the Instrumentality factor in the Motivational Force equation, in which each participant believes that his performance will lead to an outcome while Questions 14 and 15 try to measure the Valence Factor in the Motivational Force equation, which represents how the participant perceives the worthiness of the outcome and rewards.

4.5.2.3 McClelland's Motivational Theory Measurement

On Page 4, McClelland's Motivational Theory was tested by designing new items based on three types of needs (achievement, power and affiliation), as sourced from McClelland's Theory (McClelland, 1961). Therefore, as shown in Table 4.7, the questions of this theory were designed so that each question was linked with the factor that it was designed to measure.

Table 4.7 McClelland Motivational Theory (Survey Page 4)

	Question	Factor
16	I change my personal schedules in order to deliver the required task.	Achievement Need
17	Completing the work tasks makes me feel more satisfied.	Achievement Need
18	Accomplishing the task would be my first priority.	Achievement Need
19	Working with teams makes me more confident and capable of doing more.	Affiliation Need
20	Our working team members are collaborative and helpful	Affiliation Need
21	I can practice my leadership skills in this job.	Power Need
22	This job has provided me with a high level of management skills.	Power Need
23	I feel that I can lead our teams efficiently.	Power Need

As shown in Table 4.7, questions 16 to 23 were designed based on Likert scale measurement to measure the components of McClelland's motivation theory. Hence, Questions 16, 17 and 18 tried to measure the Achievement need factor. Questions 19 and 20 were designed to measure the Affiliation need factor of the participants.

Questions 21, 22 and 23 were designed to measure the Power/ Control need's factor of this sample.

4.5.2.4 Equity Theory Measurement

On Page 5, The Equity Theory was tested by designing new items based on two types of equity (Financial and Recognition equalities). Based on the premises of Equity Theory, professionals' feelings towards how equally they were treated and rewarded have become an important part of my motivational model. Several attempts have been made to capture individual differences in their preference for equity. The most dominant instruments in the literature are:

1. The Equity Sensitivity Index (ESI). This instrument was originally developed by Huseman, Hatfield, & Miles (1987). This questionnaire contains five items, each of which has two options, which the participant needs to choose from. The participant in this instrument needs to judge between what s/he gives to the organisation and what s/he gets from the organisation and points are recorded accordingly. For example: " In any organisation I might work for: I would be more concerned about:-
    i. What I received from the organisation
    ii. What I contributed to the organisation".

   ESI remains to date the most widely adopted measurement of equity sensitivity, as in the original study it demonstrated a Cronbach's alpha of 0.81 (Huseman, Hatfield, & Miles, 1985).

2. The Equity Preference Questionnaire (EPQ). This instrument was designed by (Sauley & Bedeian, 2000). The EPQ contains 16 statements regarding preference for equity in the workplace, for example:
    I. I prefer to do as little work as possible at work while getting as much as I can from my employer. (Reversed)
    II. If I could get away with it, I would try to work just a little bit slower than the boss expects. (Reversed)
    III. When I am at my job, I think of ways to get out of work. (Reversed)
    IV. It is really satisfying to me when I can get something for nothing at work. (Reversed)

The authors reported Cronbach's alpha of 0.87 and 0.86 in two pilot studies, and test-retest reliability of 0.84, using a 5-week interval between two administrations (Sauley & Bedeian, 2000).

3. The Global Measure of Equity scale (GME). This instrument was designed by Hatfield, Walster, Walster, & Berscheid (1978) to assess each couple's perceptions of how fair and equitable their relationship was. This example was extracted from a study on the benefits of sexual relationships between couples:
   I. I am getting a much better deal than my partner. (+3)
   II. I am getting a somewhat better deal. (+2)
   III. I am getting a slightly better deal. (+1)
   IV. We are both getting an equally good or bad deal. (0)
   V. My partner is getting a slightly better deal. (-1)
   VI. My partner is getting a somewhat better deal. (-2)
   VII. My partner is getting a much better deal than I am. (-3)

Despite its brevity, this widely used Global Measure of Equity has reasonable reliability and has been used to study a variety of relationship types (Traupmann, Petersen, Utne, & Hatfield, 1981).

In software engineering environments, a high equity feeling is an indispensable factor to ensure work continuity and creativity. Hence, for the purpose of this research, two types of equity were decided to be measured, which were Financial Equity Feeling and Recognition Equity Feeling.

In measuring the Financial Equity factor, the professionals' perception was assessed in terms of the financial incentives and incomes that they were receiving based on their roles and tasks, while in the measuring of the Recognition Equity factor, this study investigated how professionals were treated equally by recognition, compliments and administrative praise in the workplace. Since the equity feeling could be measured by the participants comparing themselves with others in the workplace, the Global Measure of Equity was adjusted to match software engineering purposes, as shown in Table 4.8.

Table 4.8 Equity Theory testing (Survey Page 5)

	Question	Factor
24	In the workplace I get higher financial support than my colleagues are getting.	Financial Equity
25	In the workplace, my supervisor gives me more support than he gives to my colleagues.	Recognition Equity

As shown in Table 4.8, questions 24 and 25 were designed to assess the level of financial and recognition equity feeling, respectively, based on the Equity Theory concept. The responses to these two questions should reflect to what extent professionals felt that they were treated equally in the workplace.

4.5.2.5 Goal Setting Theory Measurement

On Page 6, Goal Setting Theory is tested based on three components (feedback, commitment towards goals and task clarity) based on the measurement designed by Latham & Locke (1984). This measurement attempts to assess the core objective attributes of 'specificity' and 'difficulty', as well as other attributes of the goal-setting process (such as perceptions about 'performance feedback', 'supervisor support', 'conflict' and 'stress'). This measurement was further examined by (Lee et al., 1991), and the results of this examination supported the meaningfulness of the goal setting factors. This study has therefore adopted Locke and Latham's instrument to measure goal-setting theory applicability in software engineering environments (Latham & Locke, 1984). Accordingly, items tested in this study regarding Goal Setting Theory are shown in Table 4.9.

Table 4.9 Goal Setting Theory testing (Survey Page 6)

	Question	Factor
26	I understand what I am supposed to do in my job exactly.	Goal Setting (Task Clarity)
27	There are fair enough deadlines for accomplishing tasks and goals.	Goal Setting (Task Clarity)
28	I have suitable or sufficient action plans and tools for reaching my goals	Goal Setting (Task Clarity)
29	Goals are clearly explained to everyone in the	Goal Setting (Task Clarity)

	organisation	
30	Our managers encourage us to reach the organisation's goals.	Goal Setting (Commitment towards goals)
31	I accepted all the job's tasks because I know how to do it.	Goal Setting (Commitment towards goals)
32	I get credited and recognised when I attain the required goals.	Goal Setting (Feedback)
33	I get feedback indicating that I have reached my goals.	Goal Setting (Feedback)

As shown in Table 4.9, Questions 26 to 33 were developed to measure the three elements of Goal-Setting Theory (task clarity, commitment towards goals and feedback received on progress), these responses should mirror the amount of effort exerted by the organisation's management to meet the principles of Goal-Setting Theory.

4.5.2.6 Self-Determination Theory measure

On Page 7, Self-Determination Theory is tested based on the following two main components:

1. Intrinsic Motivation Inventory (IMI):

The Intrinsic Motivation Inventory (IMI) is a multidimensional measurement device intended to assess participants' subjective experience related to a target activity in the workplace. It has been used in several experiments related to intrinsic motivation and self-regulation e.g. (Plant & Ryan, 1985; Ryan & Connell, 1989; Ryan, Mims, & Koestner, 1983; Ryan, 1982). This instrument assessed participants' interest/enjoyment, perceived competence, effort, value/usefulness, pressure and tension felt, relatedness and perceived choice, while performing a given activity. The validity of this instrument was examined by McAuley, Duncan, & Tammen (1989) who found strong support for its validity. The Intrinsic Motivation Inventory (IMI) was adjusted slightly to match the characteristics of the software engineering industry, and then adopted to measure the participants' intrinsic motivation, level as shown in Table 4.10.

2. Extrinsic Motivation Measurement BREQ-2:

Measuring how individuals are motivated extrinsically was one of the challenges in this research design because of the lack of validated measures in the literature. However, The Behavioural Regulation In Exercise Questionnaire (BREQ) was developed by Mullan, Markland, & Ingledew (1997) to measure external, introjected and identified forms of regulation of exercise behaviour based on Deci & Ryan's (1985, 1991) conception of a continuum of extrinsic and intrinsic motivation. A further modification was performed to the BREQ in order to cover the main factors that could motivate individuals extrinsically. Hence BREQ-2 was introduced by Markland & Tobin (2004).

Although BREQ-2 was designed and tested primarily in the sport and health sectors, software engineering activities also require highly motivated individuals to perform its activities in an efficient manner, and the association between the performer's motivation level and the type of extrinsic motivation driver that influences a person could increase our understanding of how professionals in software engineering could be motivated extrinsically. Therefore, BREQ-2 was modified slightly to suit the characteristics and daily tasks of software engineering activities, as shown in Table 4.10.

Table 4.10 Self-Determination Theory testing

	Question	Factor
34	I think I am doing well at this technical work compared with other staff.	Intrinsic motivation (Perceived Competence)
35	I am satisfied with my performance at this technical work.	Intrinsic motivation (Perceived Competence)
36	I feel very tense and anxious while doing this technical work.	Intrinsic motivation (Pressure Tension)
37	My supervisor gives me more flexibility in doing tasks.	Intrinsic motivation (Perceived Choice)
38	This is an important job to do because it can reduce financial and managerial problems.	Intrinsic motivation (Job Value)
39	Doing this activity could help me to ensure my future needs.	Intrinsic motivation (Job Value)
40	I feel really close to this job.	Intrinsic motivation (Relatedness)

41	I'd like a chance to interact with my supervisor more often.	Intrinsic motivation (Relatedness)
42	It is likely that my supervisor and I could understand each other if we interacted a lot.	Intrinsic motivation (Relatedness)
43	I do my tasks because other people say I should do.	Extrinsic motivation (externally regulated)
44	I feel guilty or ashamed when I don't do my task or miss deadline.	Extrinsic motivation (Introjected)
45	I value the benefits of technical work.	Extrinsic motivation (Identified regulation)
46	It's important to me to do technical support regularly.	Extrinsic motivation (Identified regulation)
47	I feel that I am motivated when I see others working very hard.	Extrinsic motivation (Integrated regulation)
48	Sitting beside someone who has more experience than me can motivate me.	Extrinsic motivation (Integrated regulation)

As shown in Table 4.10, Questions 34 to 42 were driven from the Intrinsic Motivation Inventory IMI that was introduced by Self-Determination Theory (1984). The main types of intrinsic motivation were considered in these questions.

The extrinsic motivation items are also shown in Table 4.10, as Questions 43 to 48 were designed to measure the extrinsic motivation of the participant, based on the BREQ-2 design. Responses from these questions should provide a real insight into the most influential extrinsic motivational factors that could lead the participant to exert more effort in the workplace.

4.5.2.7 Organisational Commitment Theory Measurement

On Page 8, organisational commitment components are measured based on three items (Affective, Continuance and Normative commitment). A pre-tested questionnaire template was used in this measure, based on Meyer's and Allen employees' commitment theory. This template, called TCM Employee Commitment Survey (Meyer & Allen, 2004), measures the level of the three types of commitment (Affective, Continuance, and Normative). These questions are considered highly reliable, as they

have been widely used in most studies related to the area of commitment. This study's questions related to this theory are shown in Table 4.11

Table 4.11 Organisational Commitment Theory testing

	Question	Factor
49	I would be jubilant to spend the rest of my career with this organisation.	Affective Commitment
50	I really feel as if this organisation's problems are my own.	Affective Commitment
51	This organisation has a great deal of personal meaning for me.	Affective Commitment
52	It would be very hard for me to leave my organisation right now, even if I wanted to.	Continuance Commitment
53	I feel that I have too few options to consider leaving this organisation.	Continuance Commitment
54	One of the few negative consequences of leaving this organisation would be the scarcity of available alternatives.	Continuance Commitment
55	This organisation deserves my loyalty.	Normative Commitment
56	I would not leave my organisation right now because I have a sense of obligation to the people in it.	Normative Commitment
57	I owe a great deal to my organisation.	Normative Commitment
58	When do you intend to leave the current employer?	Options (for Criterion Validation process) see Validity section.

As shown in Table 4.11, questions 49 to 57 were designed to measure three types of organisational commitment, based on the TCM tool (Meyer & Allen, 2004).

On Page 9, a short statement of appreciation and thanks is presented to the participant. An optional text box for the participant's email and for any further comments were added to enable participants to highlight any relevant issues in the survey.

4.6 **Sampling**

The idea of sampling is to provide a useful means of enabling data collection and processing components of research to be carried out, whilst ensuring that the sample contains a good representation of the population. It is essential to obtain data from only that part of the total population with which the research is concerned. That part of the population is known as the sample (Snedecor, 1989). In addition, it allows researchers to collect data from a representative quota of the population. It is difficult for a researcher to collect data from all the population, especially when the population is quite large (Bryman & Bell, 2011). A large population will necessitate the researcher using too much time and resources to conduct surveys among all of them (Bryman and Bell, 2011). Statistical sampling involves choosing the part of the population of interest for inspection. The sampling plan should use a random probability sampling method across all the population categories, so every unit has an equal chance of being included in the sample (Hannagan, 1997). This ensures a representative and non-biased sample that is used to serve an objective survey.

When considering the selection of the sample, the researcher took into account that two forms of surveys (online and written) would be applied in software engineering environments. Hence it was necessary to devise appropriate methods of both the sample and questionnaire distribution.

There are four types of sample populations: haphazard, purposive, convenience, and random (McBurney & White, 2004).

Haphazard is a population subgroup the researcher selects without planning, organising or without having a particular pattern or structure. This type of sample is almost worthless. Hence it is not a subset of the population and it cannot reflect the population accurately (Ibid).

Purposive is a non-random sample that is based on the judgement of the researcher as to which subjects best fit the criteria of the study (Ibid).

Convenience is a non-random sample chosen for practical reasons. Such a sample is relatively adequate for some studies and similar to the purposive sample in that it selects a desirable group of people, but differs in that it may not approach the goal of sampling

all of a population (Ibid). Therefore it is not appropriate to apply statistical analysis to samples selected in this manner.

Random is a sample where each unit in the population has a known chance of being selected (Bryman and Bell, 2011). It is considered to be the most acceptable survey in terms of objectivity (Ibid).

Accordingly, the haphazard sample is ruled out, as it would cause problems in terms of reliability and validity of the data set, whereas the random sample is advised to be the most appropriate type for its scientific and objective selection process. A particular requirement exists within such samples, that is, it must be supposed that "the sampling frame is the population that is available and actually sampled" (Ibid). This issue of availability is difficult to achieve in this research for two reasons. Firstly, the population is enormous (software engineering industry) and cannot be contacted easily and there are low response rates for impersonal distribution methods, such as post, online survey or fax delivery methods. Secondly, the correct population information cannot be achieved accurately.

This, therefore, leaves the researcher with the options of a purposive sample or a convenience sample. A decision was made to choose a purposive sample and not a convenience sample, which is not suitable for statistical analysis (Ibid). A purposive sample is appropriate to apply statistical analysis, and one of the research objectives is to investigate the motivation level according to different independent factors such as contract types, team member's role and daily work, which were aimed to be investigated through quantitative methods that use statistical analysis.

4.6.1 **Pilot Study**

In order to ensure that the tool was adequately designed in terms of its phrasing, interface design, clarity, answerability and comprehension, a pilot study was conducted with 8 pilot participants. Four of them to try the online version and four try the written copy version. The pilot study was conducted with individuals who were all experienced software engineering team members and working in the industry. Data was collected and analysed from the pilot participants. From the pilot study, minor changes were made to the online survey as well as to the written copy. This was to ensure the appropriateness of the survey to the wider demographic of the sample.

4.6.2 **Ethical Issues and Confidentiality**

In order to increase the validity of this study, further efforts were made to assure the participants that their contributions would be highly confidential. This was achieved by giving each participant an empty envelope with a seal at the end of it, in order to put his or her responses in the dedicated envelope and close it with the seal after filling in his or her survey.

4.7 **Questionnaire Distribution**

As a quantitative approach was adopted in this study, a higher response rate led to a higher validity level of results. In order to achieve this goal, several different methods of promoting the study to suitable participants were used. In the web-based survey, 1105 invitations were sent by email to individuals working in the software engineering firms. Their emails were obtained by contacting IT projects' managers in software engineering firms, through different channels such as Facebook, Linked-In, Twitter, and personal networking channels. Hence, project managers agreed to provide us with their group member's emails only for the purpose of the study.

Invitation emails were sent and monitored privately using ready-made tools in (Monkeysurvey.com). The emails list was uploaded to the researcher account, then every email was sent with a specific URL to make sure that the targeted participant had taken part in the questionnaire.

For the paper copy of the survey, an in-person distribution method of the survey was used in Saudi Arabia as follows:

1) Meeting senior management at each organisation personally.
2) Obtaining permission to access IT departments.
3) Meeting IT project managers or their representatives and explaining the ethical and confidentiality issues of this research.
4) Meeting team members of software engineering projects for a quick, welcoming session and helping them to understand the scope of this study.

The reason for distributing the written copy in Saudi Arabia was that the permission that was given to this study had to be conducted officially, and also because of the sponsorship that was offered by the Ministry of Education in Saudi Arabia. Further support was granted to access many public organisations in Saudi Arabia such as:

1. Ministry of Education (MOE) (the sponsor).
2. Ministry of Commerce and Industry (MCI).
3. Ministry of Judgement (MOJ).
4. Saudi Post (SP).
5. Saudi Food and Drugs Authority (SFDA).
6. Saudi Arabian Monetary Agency (SAMA).

Based on the adopted in-person method in distributing the survey, the response rate was significantly high (59.38%), compared to other studies in the same field, as shown in Table 4.12.

Table 4.12 In-person survey distribution

	Handed out	Completed	%
MOE.	40	18	45.00%
MCI	30	21	70.00%
MOJ	20	17	85.00%
SP	23	11	47.83%
SFDA	22	9	40.91%
SAMA	25	19	76.00%
Total	160	95	59.38%

The Web-based survey managed to obtain 113 responses in a period of 3 months, so the total sample in this study was 208 participants.

4.8 **Data Analysis**

A total of 208 completed questionnaires were received from the respondents for both the written copy and the online version of the questionnaire. This number was acceptable compared to many studies conducted in software engineering environments. Returned questionnaires were analysed using quantitative data analysis methods. The data was allocated to be categorised in a database by means of a coding framework.

Although the questionnaire was designed as a one approach (survey), there were two forms of the datasets collected. These forms were:

A. Survey data stored in a database on Monkeysurvey.com (113 responses).
B. Written copies of questionnaires (95 responses).

Prior to data analysis these steps had to be followed:

A. Export online data into Excel spreadsheet file.
B. Transfer responses from paper questionnaires to Excel spreadsheet file.
C. Match questions from online and paper versions.
D. Combining responses into one unified Excel spreadsheet.
E. The new spreadsheet was exported to the Statistical Package for the Social Sciences SPSS software.

The Statistical Package for the Social Sciences (SPSS) V.21 was used in this study to test each of the hypotheses, as this package is powerful statistical software that makes better decisions with high-value data preparation, analytical reporting and modelling (Pallant, 2004). Microsoft Office Excel 2010 was also used to organise data and in the reporting process. The first step in analysing the data was to convert all data types into a numerical form instead of text form, including the demographical information, as a preparatory step to be analysed by SPSS software. Then, answers that are related to the Likert Scale were coded as (1 Strongly Disagree, 2 Disagree, 3 Neutral, 4 Agree and 5 Strongly Agree).

4.8.1 **Reliability**

Reliability refers to the issues of consistency, whereas validity is concerned with the truth of respondents' answers. In research, the term reliability means "repeatability" or "consistency". A measure is considered reliable if it gives the same result repeatedly (Trochim & Donnelly, 2001). Both reliability and validity are important and need to be considered throughout the whole of research. Measuring the reliability (and to a lesser extend validity) for survey research is comparatively easier than discussing them within the context of interview data. The following paragraphs explain how the matters of reliability and validity are dealt with for this survey.

To demonstrate the reliability of the questionnaire survey regarding the factors affecting motivation in software engineering, questions from page 3 to page 8 of the questionnaire were used in the assessment of internal consistency through its most commonly used indicator, namely Cronbach's alpha coefficient. This coefficient should be above 0.7 to demonstrate reliability (Pallant, 2004).

Reliability tests were run on SPSS for Cronbach's alpha coefficient and the current study yielded an alpha coefficient of 0.904 (see Table 4.13) for the fifty variables. This indicated a high level of internal consistency.

Table 4.13 Reliability Statistics

Cronbach's Alpha	N of Items
.904	50

4.8.2 **Validity**

Unlike the reliability test for internal consistency, the test of validity is relatively contentious since there is not an agreed means of objective assessment. Oppenheim (1992) and McQueen and Knussen (2002) suggested four tests of validity for survey research.

1. Content validity (also known as logical validity) refers to a test that precisely and sufficiently reveals the eligibility of the contents of the phenomenon under investigation.
2. Face validity refers to whether a test appears to measure what it was set out to measure. In other words, to what it seems apparently to measure. Face validity is concerned with whether the test "looks valid" to the examinees who take it, the administrative personnel who decide on its use and other technically untrained observers.
3. Criterion validity (split into both concurrent and predictive validity) is a measure of how well one variable or set of variables predicts an outcome based on information from other variables.
4. Construct validity is the extent to which the test measures a theoretical concept under investigation.

In this research, we need different types of validity at different points, as follows:

1. A criterion validity test in order to validate the measure of the Motivational Force (Expectancy Theory), as the research relies on this theory in knowing how motivated each participant is, and to what extent he/she is willing to exert more effort in the workplace. Therefore, another question was added at the end of this survey. this question asked the participant about their turnover intention as follows:

When do you intend to leave your current employer?

- Less than a year.
- Between 2-3 years.
- With the first promotion.
- I am not leaving the current employer.
- I can't leave the current employer.

Based on the concept of Expectancy Theory, people with a high Motivational Force (MF) value (explained in the survey design), will be more motivated and encouraged to stay at their organisations. Therefore, a matching test was conducted between (MF) and turnover intention question, the result is shown in Table 4.14 and Figure 4.3.

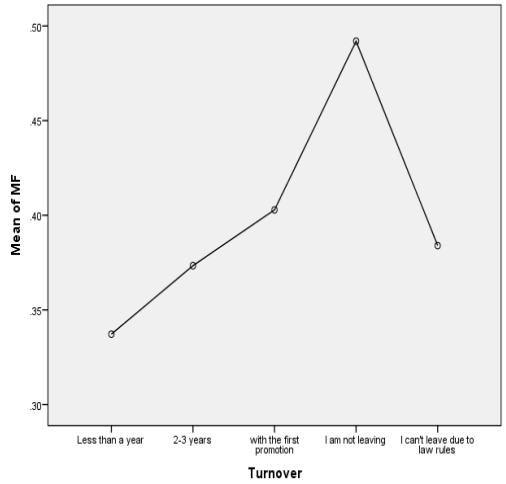


Figure 4.3 Criterion Validity of the Motivational Force

Table 4.14 MF by turnover intention means

	N	Avg Mean
Less than a year	24	0.3372
2-3 years	42	0.3734
With the first promotion	75	0.4029
I am not leaving	64	0.4920
I can't leave due to legal rules	3	0.3840
Total	208	0.4165

As shown in Figure 4.3, it is very obvious that participants who are not leaving their organisations have obtained the highest level in the Motivational Force (MF) measure. Therefore, the validity of MF measure is met statistically through the Criterion Validity approach.

Since the other items used in this study's survey (page 4 to page 8) are deemed to be either stand-alone or driven from pre-tested tools from different theories, the criterion validity appeared to be less relevant to them. In terms of other tests of validity, the acceptable response rate mentioned above is evidence of its face validity. Where content and construct validity are concerned, these are secured through the literature review and exploratory interviews, and more importantly, the feedback received from

academic and industrial advisors throughout the design and the sampling of the questionnaire survey.

4.8.3 **Normality**

Assessing variables for normality is important where a statistical conclusion is an objective (Tabachnick & Fidell, 2001). Normality can be assessed by either statistical or graphical means. The statistical measurements include the computations of the Kolmogorov-Smirnov test (often called the K-S test) and kurtosis and skewness values.

Ideally, the Kolmogorov-Smirnov value should be more than 0.05 (representing non-significant result) whilst the kurtosis and skewness values should be zero (to indicate normality). Graphical measurements concern the visual assessment of the histogram and normal Q-Q and de-trended Q-Q plots. In statistics, a Q-Q plot (Q stands for quantile) is a graphical tool for diagnosing differences in distributions (Pallant, 2004). Accordingly, the graphical measures reveal whether the theoretical frequency distribution for a set of variable data has a normal distribution or has a non-normal distribution. It is usually represented by a bell-shaped curve symmetrical about the mean (also called Gaussian distribution). Normal distribution has the following essential characteristics: (1) the curve has a single peak; (2) it is bell-shaped; (3) the mean (average) lies at the centre of the distribution, and the distribution is symmetrical around the mean; (4) the two tails of the distribution extend indefinitely and never touch the horizontal axis; (5) the shape of the distribution is determined by its Mean (μ) and Standard Deviation(s) (Mayhew, 2004).

Tests for normality were run using SPSS on the average of each set of questions that were related to one factor. For example: normative commitment is measured through three questions, so the average mean of these three questions is calculated.

Each factor is entered into the dependent list box and independent group variables are entered into the factors list box. Missing values are marked as excluded cases, pairwise. This approach gives the ability to apply testing of the normality of the distribution of all the dependent and independent variables. Also, the mean is used for each dependent variable, so as to arrive at a total score for each dependent variable with regard to the Kolmogorov-Smirnov test and the kurtosis and skewness values.

Results show that most of the variables scored less than 0.05, which means that the distribution of the dataset is non-normal. However, this is common in large samples (Pallant, 2004). The dependent list consists of many factors related to six motivational theories (summarised from 50 questions in the survey), and the independent factors comprise five factors (age group, member role, daily work, contract type and citizenship).

The result of the normality test from SPSS cannot be presented in this thesis entirely, as the results consist of a very long list of numbers and tests related to each independent factor. However, the normality test of the daily work factor is presented below as an example of the results.

Table 4.15 Tests of Normality of Daily work factor

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Daily Work	Statistic	df	Sig.	Statistic	df	Sig.
Equal Pay	Operations	.212	40	.000	.880	40	.001
	Projects	.202	44	.000	.854	44	.000
	Both (Operation + projects)	.199	124	.000	.901	124	.000
Equal Recognition	Operations	.214	40	.000	.899	40	.002
	Projects	.227	44	.000	.901	44	.001
	Both (Operation + projects)	.206	124	.000	.904	124	.000
Need for achievement	Operations	.183	40	.002	.946	40	.056
	Projects	.162	44	.005	.917	44	.004
	Both (Operation + projects)	.175	124	.000	.933	124	.000
Need for affiliation	Operations	.273	40	.000	.861	40	.000
	Projects	.335	44	.000	.807	44	.000
	Both (Operation + projects)	.303	124	.000	.827	124	.000
Need for control	Operations	.179	40	.002	.920	40	.008
	Projects	.163	44	.005	.915	44	.003
	Both (Operation + projects)	.207	124	.000	.898	124	.000

From Table 4.15 above, it is evident that the statistical results suggest that the distribution of the dataset is non-normal. However, Pallant (2004) notes that a Kolmogorov-Smirnov statistic of less than 0.05 is quite common in large samples.

4.8.4 **Results of the Survey**

This section reports the results of the questionnaire survey from the data analysis in the format of general descriptive statistics. Then, in Chapter Five, further analyses, including statistical tests and discussion, will be presented.

The survey was completed by 208 participants from the software engineering industry. The survey results are first presented as raw numerical data from all of the participants, and are presented using selective groupings based on pre-set criteria and the independent variables.

As shown in Figure 4.4, the majority of this sample population were in the age groups between 35 and 44 years old (45 %), and 25-34 (43 %). The lowest percentages were for participants in age groups 55-64 and under 18, with 2% and 0.48% (just one participant) respectively.

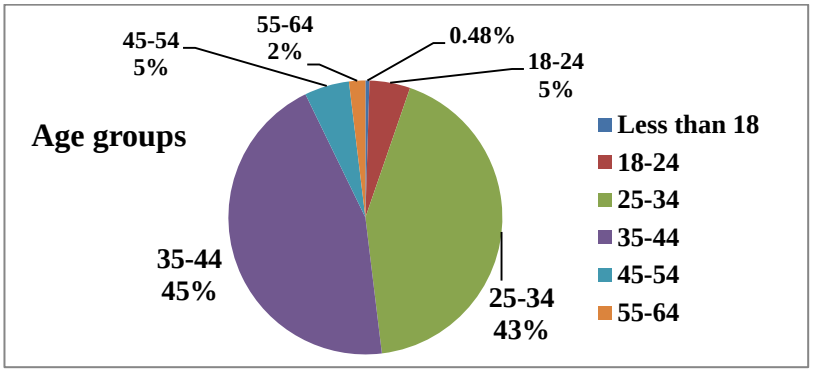


Figure 4.4 Participants' age groups

The responses were derived from two sources, a web-based survey and paper-based survey, and the participants were distributed over these two categories as shown in Table 4.16

Table 4.16 Age groups by survey source

	Under 18	18-24	25-34	35-44	45-54	55-64	Total
Paper-based survey	1	9	59	22	2	2	95
Web-based Survey		1	30	71	9	2	113
Total	1	10	89	93	11	4	208

The majority of the sample in the paper-based survey was from the age group (25-34), whereas the majority in the web-based survey were in the age group (35-44). This

provides a good indication that this sample comes from relatively close age groups, at a similar point in their career cycle.

In terms of the participants' roles in the software engineering environment, Figure 4.5 shows that 58% of the sample was from the Technical Work segment, which involves development, interfaces design, networks and database administration jobs. 31% of the sample work as IT project managers or team leaders, which involves more responsibilities towards the planning and accomplishment of projects. Participants with roles in administration work in software engineering environments made up 11% of the sample. This kind of work involves coordinators, help desk and other administrative tasks related to software engineering projects.

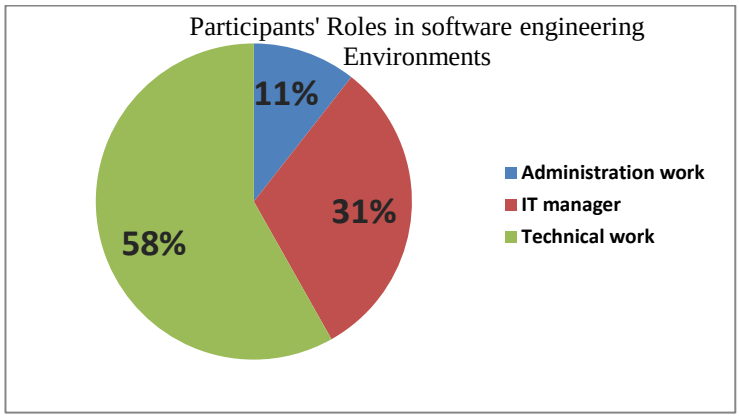


Figure 4.5 Participants' Roles

The majority of participants in this sample were male, with 194 participants (93 %), whereas there were only 14 females (7%), as shown in Figure 4.6. This low percentage was explained in the research scope and limitations page 1-3.

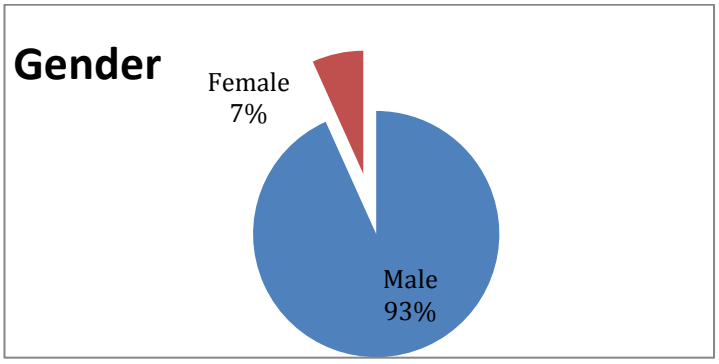


Figure 4.6 Participants' genders

Genders are distributed over all types of group members' roles, as shown in Table 4.17. It can be seen that technical work's role account for most of the sample population, both male and female. Females' participation in this research is limited because of the Saudi Arabian culture, and the difficulties in accessing females' workplaces in Saudi Arabia

as explained in the research scope and limitation page 1-3. Thus, testing genders hasn't been considered in this research due to low validity of the representative sample of the female group.

Table 4.17 Team members' roles by gender

Role	Male	Female	Total
Administration work	21	1	22
IT manager	61	4	65
Technical work	112	9	121
Total	194	14	208

In terms of the participants' qualifications, as shown in Figure 4.7, holders of Bachelor's Degrees are the larger group with 60 % out of the sample population. Most of these work in technical-based work, as shown in Table 4.18 . Master's degree holders come in second place, with 34 % of the sample, most of whom are project managers in software engineering environments.

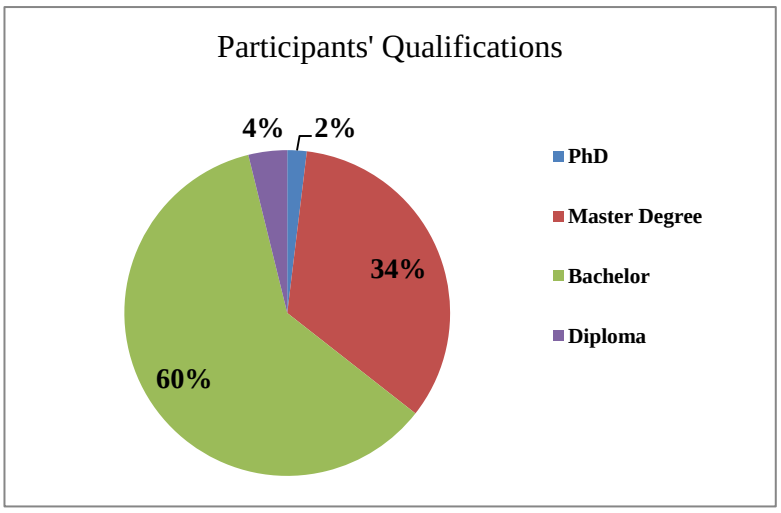


Figure 4.7 Participants' Qualifications

From Table 4.18, qualifications were distributed over the participants' roles in software engineering teams. Bachelor degree holders were the majority in both administration and technical work, with 13 and 90 participants respectively. Whereas in the group of 70 Master's degree holders, 39 of them were in project manager roles, 24 were in technical work and only 7 participants were involved in administrative-based work in IT departments. This sample also included 4 PhD degree holders, 3 of whom were project managers in software engineering, whereas only one was in a technically based role.

Table 4.18 Qualification by roles

Role	PhD	Master Degree	Bachelor	Diploma	Total
Administrative work		7	13	2	22
IT manager	3	39	23		65
Technical work	1	24	90	6	121
Total	4	70	126	8	208

In terms of the nature of daily work, 60% of this sample performed two types of tasks in their daily duties (projects and operations), whereas participants who were dedicated to just project or operational work accounted for 21 % and 19% of the sample respectively, as shown in Figure 4.8.

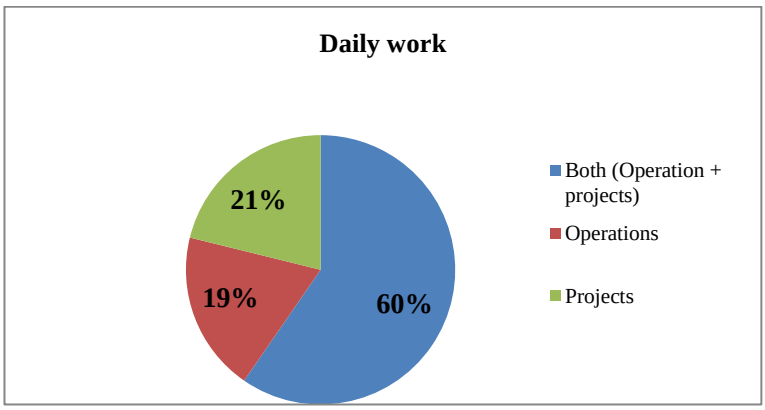


Figure 4.8 Nature of participants' daily work nature

From Table 4.19, it can be seen that 124 of the participants engaged in tasks under projects and operations duties in the software engineering industry, while the rest of the participants were almost equally divided between projects and operations only.

Table 4.19 Daily work nature

Daily Work nature	Total
Both (Operation + projects)	124
Operations	40
Projects	44
total	208

The nature of participants' daily work was distributed over the type of roles in their daily work, as shown in Table 4.20

Table 4.20 nature of daily work by members' roles

Daily Work	IT manager	Technical work	Coordination staff	Total
Both (Operation + projects)	53	64	7	124
Operations	7	22	11	40
Projects	5	35	4	44
Total	**65**	**121**	**22**	**208**

From Table 4.20, it can be seen that most of the technical participants were involved in projects, whether under the projects only category or in both projects and operations categories. However, the coordination staff role is seen mostly in the operations category rather than the projects category. Noticeably, project managers were holding responsibilities in project-based work rather than operations.

Regarding participants' types of employment contracts, as shown in Table 4.21, the largest group of these participants, 46%, were working on annual contracts, followed by those on project-based contracts, with 21 % of the study's population.

Table 4.21 Participants' contract types

Contract Type	N	%
Annual-based	**97**	**46.6**
Government permanent	**37**	**17.7**
Project-based	**45**	**21.6**
Unpaid workers	**3**	**1.4**
Private business	**26**	**12.5**
Total	**208**	

The percentages of each contract type are presented in Figure 4.9

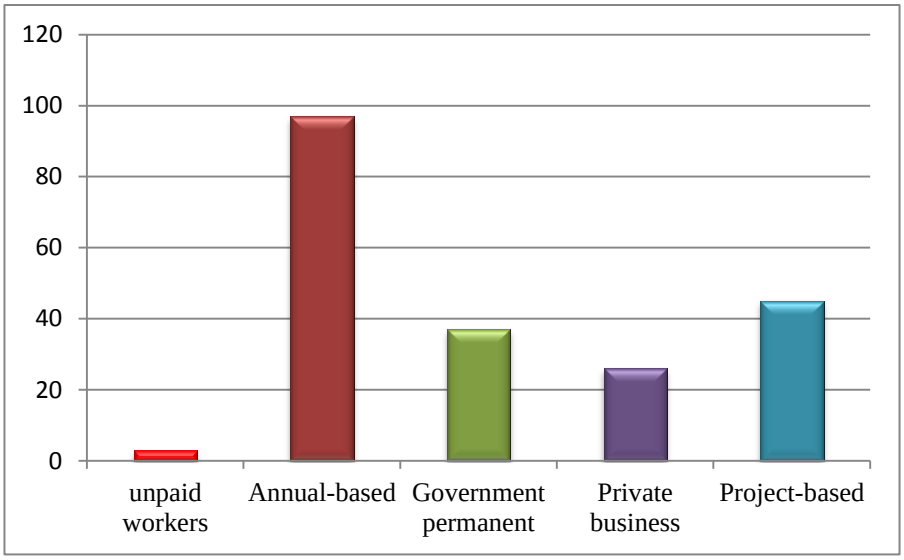


Figure 4.9 Participants' contract types

Presenting the distribution of members' roles according to their contract forms could provide valuable information as to how they are contracted and sought in the software engineering market. Table 4.22 shows that IT managers and technical staff are mostly contracted by annual agreement, whereas coordination staff are contracted for the duration of the projects' lifecycle. This may reflect the importance of the continuity of IT managers and technical professionals, regardless of the availability of projects in the organisations. Moreover, the governmental segment employs few software engineering professionals. However, this could be attributed to the governmental restriction on employees' salaries and financial incentives in software engineering departments.

Table 4.22 Members' roles by contract types

	IT manager	Technical work	Coordination staff	N
Annual-based	37	55	5	97
Government permanent	5	27	5	37
Private business	12	11	3	26
Project-based	10	26	9	45
Unpaid workers	1	2	0	3
Total	65	121	22	208

4.8.5 **Current Motivation and Turnover Intention**

In two separate categorical questions in the first question, participants were asked to state the motivators that they were currently receiving, the choices were as follows:

- Monetary.
- Constant recognition.
- Monetary and constant recognition.
- I am not receiving any incentives.

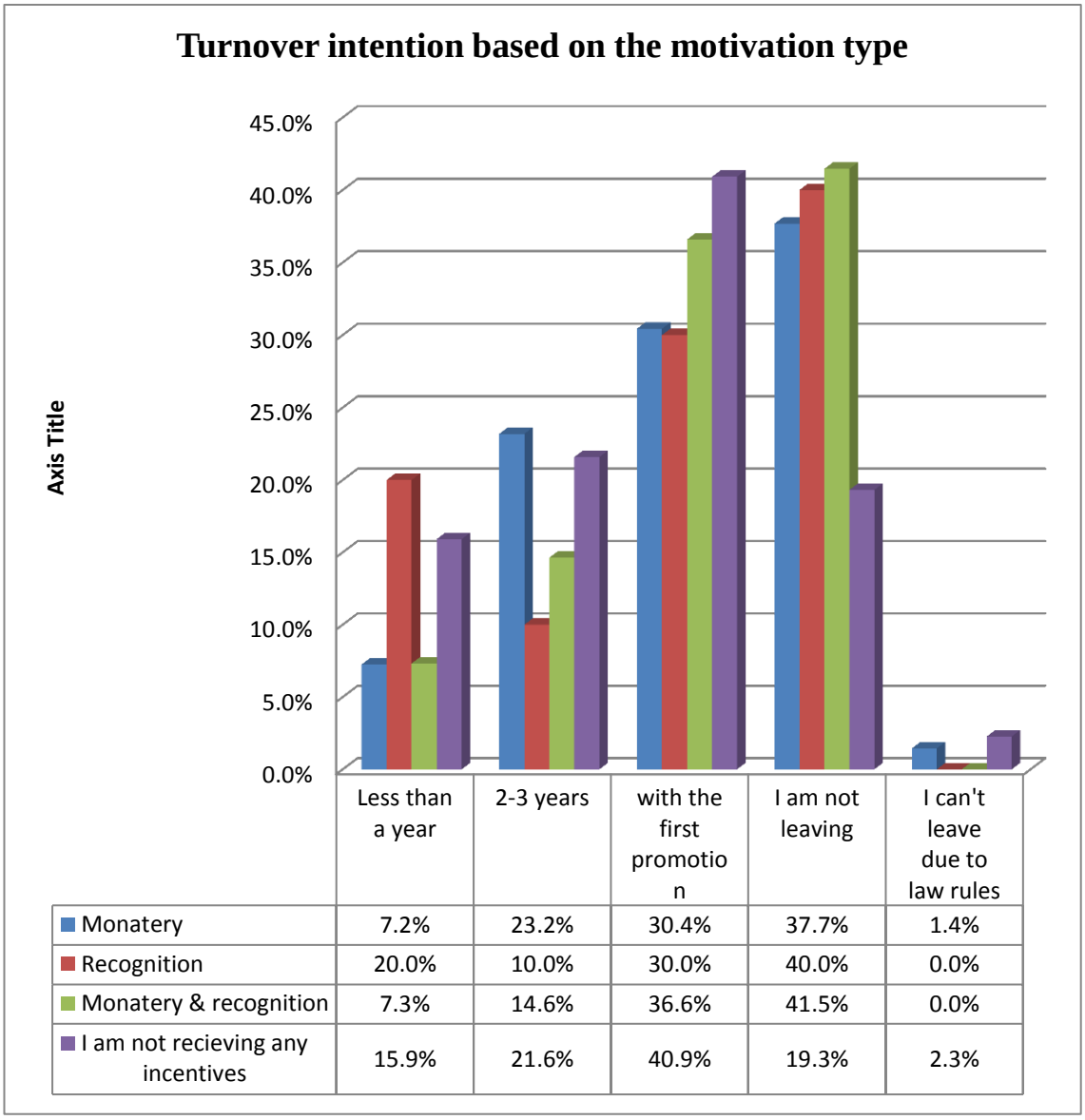
In the second question, participants were asked to state their reason for leaving their current employer. The choices were (Less than a year, 2-3 years, with the first promotion, I am not leaving and I can't leave due to legal rules).

Therefore, matching these two questions might provide a profound insight into how retaining employees in software engineering is more complicated than expected. The statistical matching is shown in Table 4.23.

Table 4.23 Turnover intention cross current motivator

		Turnover intention period					
Current motivator		Less than a year	2-3 years	With the first promotion	I am not leaving	I can't leave	**From All Total**
Monetary	Count	5	16	21	26	1	69
	%	7.2%	23.2%	30.4%	37.7%	1.4%	33.2%
Recognition	Count	2	1	3	4	0	10
	%	20.0%	10.0%	30.0%	40.0%	0.0%	4.8%
Monetary & recognition	Count	3	6	15	17	0	41
	%	7.3%	14.6%	36.6%	41.5%	0.0%	19.7%
Not receiving any incentives	Count	14	19	36	17	2	88
	%	15.9%	21.6%	40.9%	19.3%	2.3%	42.3%
Total	Count	24	42	75	64	3	208
	%	11.5%	20.2%	36.1%	30.8%	1.4%	100.0%

Splitting numbers presented in Table 4.23 into four graphical figures provides an easier understanding of these figures, as shown in Figure 4.10.



	Less than a year	2-3 years	with the first promotion	I am not leaving	I can't leave due to law rules
Monatery	7.2%	23.2%	30.4%	37.7%	1.4%
Recognition	20.0%	10.0%	30.0%	40.0%	0.0%
Monatery & recognition	7.3%	14.6%	36.6%	41.5%	0.0%
I am not recieving any incentives	15.9%	21.6%	40.9%	19.3%	2.3%

Figure 4.10 Turnover intention based on applied motivation

As shown in Table 4.23, although more than 42.3 % of the sample (88 participants) were not receiving either monetary nor recognition motivators in workplaces, 19.3% of them were not planning to leave their current employer. However, participants who received only monetary incentives were second, with 33%. Although 37.7% of them were not planning to leave their current employer, 30.4% were planning to leave in after their first promotion. This could provide enough evidence that monetary incentives do not guarantee an employee's commitment to the employer, and hence, add more importance to investigating the other motivation sources in software engineering environments.

4.9 **Chapter Summary**

The findings in this chapter generally confirmed the findings of the literature review, in terms of the factors affecting the motivation level in software engineering. Also, the chapter presented these factors in terms of their applicability to the software engineering industry. This was done through qualitative interviews with IT managers and experienced personnel in software engineering firms and resulted in the identification of several additional factors affecting motivation level in software engineering contexts. The third phase of the research, which aimed to collect data supporting the importance of conducting this study, and to examine the newly identified factors, has been reported in this chapter.

The preliminary study also showed that the lack of motivation influences software engineering projects' continuity, i.e. delay in execution of the project and poor management of the project. This supports the research problem and supports the need for a model to aid software engineering decision makers in motivating their employees effectively.

The preliminary study helped in drawing this research map by providing a list of dependent and independent factors as shown in Table 4.3. It presented the effects of several independent factors such as team members' roles, contract types, age, work location and work type on an individuals' motivation levels in software engineering in the light of several motivational theories including Expectancy Theory, McClelland's Theory, Self-Determination Theory, Equity Theory, Organisational Commitment, and Goal Setting Theory.

This study's questionnaire was designed as a cross-sectional survey, collecting data at one point in time for a self-selected sample of software engineering professionals. In the results section, the demographical data was presented and explained briefly. The initial results provided a good indication of the diversity of the study sample, as the participants were from different organisations, playing different roles in the projects, and holding different types of contracts and agreements.

The descriptive analysis of the collected data indicated evident signs of the complexity of the motivation in software engineering environments as shown in Table 4.23. A rational model was recommended to be used in producing the developed model.

The main findings of the questionnaire survey support the importance of conducting this research, as it could contribute to solving the problem of using motivation tools inappropriately in software engineering environments. Therefore, further analysis will be conducted in the next chapter, in order to use more statistical procedures to test the new factors in the light of six motivational theories. SPSS software will be used in performing means comparison tests such as t-test, ANOVA and Welch, as well as two types of correlation tests, the Pearson correlation coefficient and Spearman correlation. The reason for selecting these tests is explained, and the conditions for each test are met statistically.

Chapter 5. QUESTIONNAIRE SURVEY ANALYSIS AND DISCUSSION

5.1 Chapter Overview

The previous chapter reported on the results of the preliminary study and the questionnaire survey. Further analyses are needed using the comparison of means and correlation techniques to test the independent factors in this study in the light of six motivation theories (Expectancy Theory, McClelland's Theory of Achievement, Equity Theory, Goal Setting Theory, Self-Determination Theory and Organisational Commitment Theory). Each theory describes the motivation from different perspectives by adopting different factors. Therefore 50 questions were designed in this study, aiming to measure the level of each theory's components in software engineering environments. A second aim of this chapter is to monitor the statistical correlation between these components and the motivation level of the participant. Motivational Force was calculated based on the Expectancy Theory concept and was used to measure the motivation of the participants.

At the end of this chapter, it is expected to have many statistically proven results showing the contribution of this work to the field of motivation in software engineering. However, more validation is required in the forthcoming chapters.

5.2 Approach to Analysis

The data was allocated and categorised by means of a coding framework, using the statistical package for the social sciences database (SPSS). The quantitative analysis was also done using SPSS, which is a powerful statistical software package. The data was prepared for entry into the SPSS by coding, ranking, and labelling. Then the required analysis for each part of the questionnaire was undertaken to determine frequencies and percentages, compare means, and identify correlations. The SPSS software was also used to prepare tables, figures and charts to present the results.

Based on the results of the last chapter (Chapter 4), different theories need to be tested in this chapter in order to provide a useful insight into how motivation could be driven in software engineering environments. Therefore, it was decided to conduct five stages

of inferential analysis in this chapter in order to achieve this study's aims and objectives. These stages, with the statistical tests required at each stage, are shown in Table 5.1.

Table 5.1 Inferential Analysis stages

Stage No.	Stage Name	Statistical tests
1	The influence of team members' role on the components of McClelland's Theory of Achievement.	Means comparison
	Testing the correlation between McClelland's Theory of Achievement and Motivational Force.	Correlation test
2	The influence of a team member's role on the components of Equity Theory.	Means comparison
	Testing the correlation between Equity Theory and Motivational Force.	Correlation test
3	The influence of daily work types on the components of Goal Setting Theory.	Means comparison
	Testing the correlation between Goal Setting Theory and Motivational Force.	Correlation test
4	The influence of contract types on the components of Self-Determination Theory.	Means comparison
	Testing the correlation between Self-Determination Theory and Motivational Force.	Correlation test
5	The influence of contract types, age group and citizenship on the components of the organisational Commitment Theory.	Means comparison
	Testing the correlation between Organisational Commitment Theory and Motivational Force.	Correlation test

As shown in Table 5.1, five stages were decided to be followed to answer the research questions. At each stage, a different theory was tested based on various independent factors. However, they were all expected to be combined into one integrated model, as they were all tested against one component, the Motivational Force (MF).

5.3 Quantitative Methods Used

In the inferential analysis, five different stages were followed in order to achieve this study's aim and objectives.

5.3.1 The Motivational Force Measurement (MF)

This research relies on the Expectancy Theory concept in designing a valid tool that measures motivation level in the sample. The level of motivation is significantly important in this part of this research, as this level will be monitored and tested over all of the five stages, as shown in Table 5.1.

The concept of Expectancy Theory was explained in Chapter 2 (the Literature review), and this tool was validated in Chapter 4 (see 4.8.2 Validity), as the Criterion Validation method was used to validate this tool before using it in this chapter to justify any significant results.

5.3.2 Member Roles: (Management, Technical, Co-ordination)

Roles in software engineering environments could be explained in different dimensions. Roles could be specified in-depth by dividing the profession based on the specific work that is being practised during the software development. For example, DBA, J developer, Oracle Developer, Web designer, business analyst, software engineer, technical support. However, in this study, these jobs were grouped into three main categories based on the relation between the person's role and the area of software development:

- Project management roles. This involves project managers, departmental administrators, and those holding any high level of authority in an IT department.
- Technical roles. This involves all the technical work that is directly correlated to software manufacturing, such as developers, analysts, DBAs and designers.
- Coordination and support staff. This category involves all subordinates who serve as the support line for the technical members of the group.

5.3.3 **Daily Work: Projects & Operations**

In this research, and based on the preliminary study, it has been suggested that individuals who are working on projects are mostly goal-oriented performers, whereas individuals working in operations and daily routine jobs are less committed to the organisation's goals and objectives. Therefore, these two types of daily work were considered as independent factors in this research model.

Operations Management refers to the ongoing organisational function that performs activities to produce products or supply services. For instance, network security operations, procurement, IT service management, and maintenance operations. Operations are permanent endeavours that produce repetitive outputs. Resources are assigned to do the same tasks according to operating procedures and policy (Webster, 2014).

In contrast, projects are temporary and help the business to meet organisational goals and to respond quickly and efficiently to the external environment. Organisations usually adopt projects to change operations, products and services to meet business needs, gain competitive advantage and respond to new markets or new strategies (Webster, 2014). Practically, projects require project management skills and knowledge, whereas operations require process management (or operation management). However, projects and operations rely on each other at various points during the life-cycle of a product or service, such as re-engineering business processes or the development of software(CSCMP & Sanders, 2013).

5.3.4 **Contract Types**

The impact of employment contracts on IT staff commitment and motivation has been given considerable importance in recent research conducted by Atkinson & Benefield (2013). Their study revealed that the type of contract used for business engagement varies depending on the scope of the business and the nature of the industry. They also pointed out "a flexible contract allows you to be responsive to changing business needs, whereas adopting a traditional contract in IS development will increase the risk of the project's failure". In addition, Atkinson & Benefield, (2013) developed a new contract model tailored specifically to the IS development sector.

Thus, it appears the contract type factor is considered influential in software engineering, and hence, different types of contracts could have different impacts on the motivational level of professionals in software development environments.

5.4 Stage 1: Testing McClelland's Theory in Software Engineering

In this stage, a deductive study was conducted to firstly test the influence of the team member's role type on the application McClelland Theory in software engineering and secondly how McClelland Theory's components' interact with the Motivational Force level of individuals working in software engineering environments.

5.4.1 Theoretical Framework

In this stage, a deductive study was conducted to test the influence of meeting McClelland's Theory of Achievement's needs on the Motivational Force of individuals working in software engineering environments.

McClelland's Theory of Achievement attempts to explain and predict behaviour and performance based on a person's need for achievement, power, and affiliation (Lussier & Achua, 2007, p. 42, cited in Moore, Grabsch, & Rotter, 2010). In essence, McClelland's Theory of Achievement postulates that people are motivated, but in various degrees by their need for achievement, power and for affiliation and that these needs are acquired or learned, during an individual's lifetime (Daft, 2008; Lussier & Achua, 2007). In other words, most people possess and will exhibit a combination of these three needs during their performance. Therefore, the impetus to maximise the efforts of members of the software engineering profession has created the aim of pursuing in detail the study of their types of needs and how these needs could be met, and how their needs are influenced by software engineering environments.

The theoretical framework for this stage is rooted in McClelland's Achievement Motivation Theory as the interaction between three types of needs and motivational force is tested among this study's sample, as shown in Figure 5.1, which will eventually be added to the integrated model of motivation in software engineering.

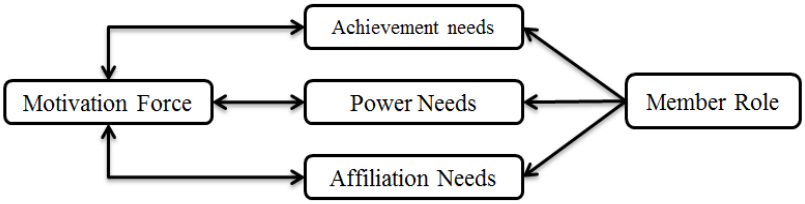


Figure 5.1Three Needs model

The suggested model, as shown in Figure 5.1 utilises the following hypotheses to be tested in this study (as presented in pages 4-84, Interpersonal factors' group:)

* * Hypotheses are numbered based on (H.X.Y) form where (H: Hypothesis, X: is the group name A,B or C. Y: the sequence number of the hypothesis ,1,2,3…)

H.A.1 Individuals working in software engineering have a different satisfaction level for each of the three types of needs (achievement, control and affiliation), based on the role that they are playing in the projects.

H.A.5. H.A.2 The level of Achievement Need factor is correlated statistically with the Motivation Force level in software engineering environments.

H.A.3 The power and need factor is correlated statistically with the Motivation Force level in software engineering environments.

H.A.4 The fulfilment in affiliation need factor is correlated statistically with the Motivation Force level in software engineering environments.

The first hypothesis requires statistical comparison of the means of the three types of needs, based on the type of role the member plays in software engineering projects. The parametric measure one-way ANOVA and the non-parametric measure Welch test are the methods applied for this kind of testing. However, means' comparison tests require meeting the following assumptions:

- The dependent variable is normally distributed in all the factor groups.
- The dependent variable does not present significant outliers in any of the factor groups.
- The dependent variable has equal variances in all factor groups (there is homogeneity of variances).

5.4.2 **Normality and Outliers**

Since the sample size is quite large, the analysis of variances will be run regardless of the normality assumption, as the violation of this assumption does not affect the false positive rate (Glass, Peckham, & Sanders, 1972; Harwell, 1992; Lix, Keselman, & Keselman, 1996).

Outliers were checked by boxplot diagrams for the three dependent variables and the results showed that there were no influential outliers in this statistical process, relative to the size of the sample.

5.4.3 **Homogeneity Test**

Testing the homogeneity of the variance by Levene's test is fundamental in order to determine the type of tests to be performed (parametric or non-parametric). If the result showed a homogeneous variance, the ANOVA test would be the appropriate test, and if not, then the Welch test would be appropriate, as it is a non-parametric test for comparison of means. The results of the Levene test for homogeneity of variances can be examined in Table 5.2.

Table 5.2 Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Power need	.011	2	205	.989
Achievement need	6.365	2	205	.002
Affiliation need	2.035	2	205	.133

The assumption of homogeneity of variances is met in two factors (power need and affiliation need), as assessed by the Levene statistic (p=0.989 and p=0.133) respectively. Therefore, the influence of member's roles on their power and affiliation needs factors will be tested by the ANOVA test.

In terms of the achievement need factor, this is considered as non-homogeneous as assessed by the Levene statistic (p=0.002), therefore, the robust test of equality of means (Welch) will be considered for this factor. The results of this analysis are given in Table 5.4.

5.4.4 **Means Comparison Tests**

In terms of the two factors Power Need and Affiliation Need, the results of the ANOVA test are presented in Table 5.3 while the result of Achievement factor (Welch test) is shown in Table 5.4.

Table 5.3 ANOVA test for power and affiliation

		Sum of Squares	df	Mean Square	F	Sig.
Power need	Between Groups	1.683	2	.841	1.192	.306
	Within Groups	144.691	205	.706		
	Total	146.374	207			
Affiliation need	Between Groups	1.367	2	.684	1.254	.288
	Within Groups	111.785	205	.545		
	Total	113.153	207			

As shown in Table 5.3, the ANOVA test results for both power need and affiliation need factors are greater than 0.05, showing significance levels of p=0.306 and p=0.288 respectively. Therefore, the null hypothesis is accepted for each of these two factors, by saying that there is no significant difference between the factor group means for each dependent variable, power needs and affiliation need. Therefore, this test reveals that the group member's role does not influence the power need and affiliation need factors.

Table 5.4 Welch test for achievement need

Robust Tests of Equality of Means

Achievement needs

	Statistic[a]	df1	df2	Sig.
Welch	3.197	2	53.732	.049

a. Asymptotically F distributed.

The value of the Welch statistic with 2 and 53.732 degrees of freedom is 3.197, p=0.049. Since the p-value of the F-test is lower than 0.05, then the null hypothesis is rejected by saying that there are significant differences overall between the means of the participants' group roles for the dependent variable Need for Achievement. It could be concluded that the team member's role has an influence on their achievement needs.

In order to identify which role is different from other roles in terms of the members' Need for Achievement, the Games-Howell test for multiple comparisons was performed and the results are presented in Table 5.5.

Table 5.5 Games-Howell test for multiple comparisons

Multiple Comparisons

Dependent Variable: Achievement needs

Games-Howell

(I) Member role	(J) Member role	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Coordination staff	IT manager	-.45804*	.18006	.044	-.9052	-.0109
	Technical work	-.40496	.17875	.079	-.8496	.0397
IT manager	Coordination staff	.45804*	.18006	.044	.0109	.9052
	Technical work	.05308	.08075	.788	-.1380	.2441
Technical work	Coordination staff	.40496	.17875	.079	-.0397	.8496
	IT manager	-.05308	.08075	.788	-.2441	.1380

*. The mean difference is significant at the 0.05 level.

As seen in Table 5.5, a few points have emerged as follows:

1. The mean difference in achievement needs between the “IT manager” and “coordination staff” groups is 0.458 and is statistically significant (p=0.044). The 95% confidence interval in the total population is 0.010, 0.905.
2. The mean difference in achievement needs between the “IT manager” and “technical work” groups is 0.053 and is not statistically significant (p=0.788).
3. The mean difference in achievement needs between the “technical work” and “coordination staff” groups is 0.404 and is not statistically significant (p=0.079).

In addition, Figure 5.2 shows that the average of the means of these three groups (coordination staff, IT managers and technical professionals) are 3.78,4.22 and 4.20 respectively , which means that coordination staff have a lower level of Achievement need than other groups in software engineering environments.

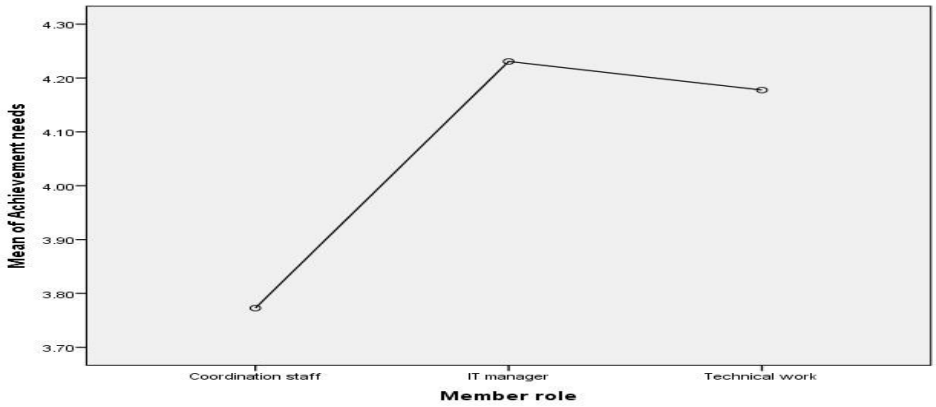


Figure 5.2 Achievement needs means

In conclusion, the coordination staff group is statistically different from other groups in terms of their needs for achievement in software engineering projects.

5.4.5 **Correlation Test between the Motivational Force and Three Needs**

A series of correlation analyses were run in order to determine whether there was a significant relationship between the variable "motivation force" on the one hand, and the variables need for power, affiliation and achievement, on the other.

The assumptions that must be checked before running a correlation analysis are:

- The relationship between the variables is approximately linear.
- The variables are approximately normally distributed.
- The variables do not present significant outliers.

In terms of the linearity of the relationship between these variables, the relationship between motivational force and power needs, as well as the relationship between motivational force and affiliation needs, could be described as being approximately linear, as shown in Figure 5.3 and Figure 5.4, but the relationship between motivational force and achievement needs is quite far from linear, as shown in Figure 5.5, so this may be problematic.

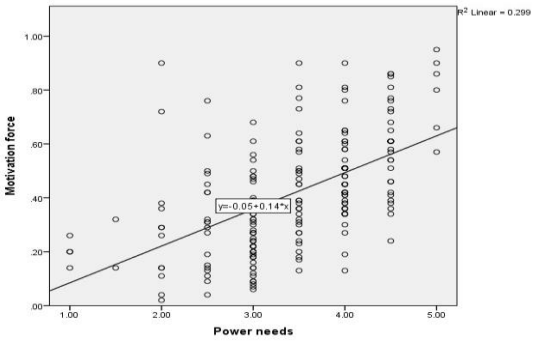


Figure 5.3 Linear test for Need for Power

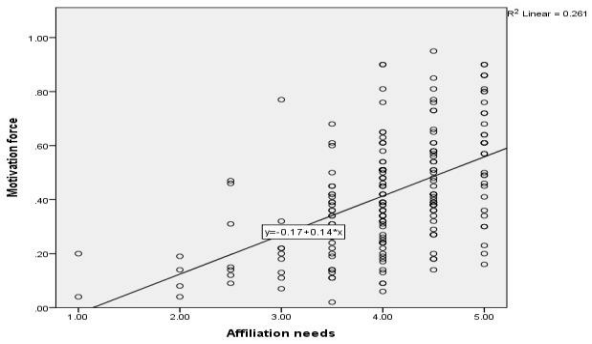


Figure 5.4 Linear test for Need for Affiliation

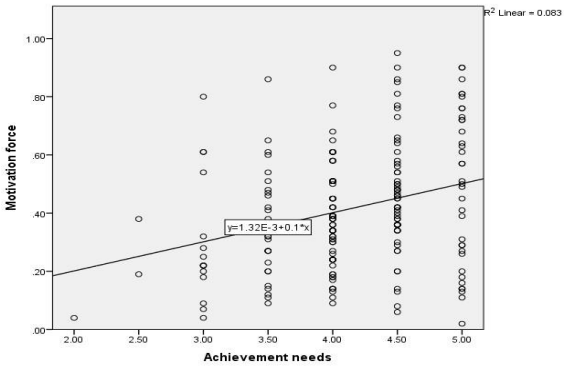


Figure 5.5 Linear test for Need for Achievement

A series of Shapiro-Wilk normality tests were run to determine whether the study variables were normally distributed or not. The results of these tests could be seen in Table 5.6.

Table 5.6 Normality test

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Power needs	.163	208	.000	.944	208	.000
Affiliation needs	.209	208	.000	.888	208	.000
Achievement needs	.189	208	.000	.910	208	.000
Motivation force	.064	208	.040	.977	208	.002

a. Lilliefors Significance Correction

None of these variables of interest were normally distributed, as assessed by the Shapiro-Wilk test ($p<0.05$).

In terms of outliers, (assumption 3), most of the variables presented a small number of moderate outliers. However, they would not affect this analysis. Given the issues related to assumptions 1 and 2, both Pearson and Spearman correlation tests were decided to be performed for these variables and then their results compared.

The Pearson and Spearman tests were run simultaneously; the results are shown in Table 5.7.

Table 5.7 Pearson and Spearman Correlations tests

	Pearson test	Motivational Force	Spearman's test	Motivational Force
Power Need	Pearson Correlation	.547**	Correlation Coefficient	.583**
	Sig. (2-tailed)	.000	Sig. (2-tailed)	.000
	N	208	N	208
Affiliation need	Pearson Correlation	.510**	Correlation Coefficient	.504**
	Sig. (2-tailed)	.000	Sig. (2-tailed)	.000
	N	208	N	208
Achievement need	Pearson Correlation	.288**	.260**	.260**
	Sig. (2-tailed)	.000	.000	.000
	N	208	208	208

As shown in Table 5.7, The results of Pearson and Spearman tests revealed that all the three factors (a need for power, affiliation and achievement) were positively correlated with the Motivational Force factors, as they showed correlation coefficient values

(0.583, 0.504 and 0.260) respectively for the Spearman Correlation Coefficient. However, the achievement need factor had a weak correlation coefficient value.

Since the results of the Pearson and Spearman correlation tests are similar, it could be concluded that the violations of the assumptions do not affect the analysis. Therefore, the results confirm that there are statistical correlations between the three types of need and level of Motivational Force in software engineering environments.

5.4.6 **Summary of Stage 1**

This study has followed a deductive approach to testing the applicability of McClelland's Theory of Achievement (1961) in software engineering settings. The results from the inferential analysis show the following conclusions:

- The need for power and controlling others and the need for affiliation in software engineering environments, whether it is high or low, is equal to all software engineering roles for these participants.
- The need for achievement for the coordination staff group is less, and is and statistically different from other groups in software engineering projects.
- There is a statistical correlation between the three types of needs (affiliation, power and achievement) and the Motivational force level in this sample.

In conclusion, my hypothesis (H.A.1) was rejected for two types of needs (power and affiliation). However, it was accepted at the need for achievement, in distinguishing the role of coordination staff from the other two roles types (IT managers and technical work staff). My hypotheses (H.A.2 , H.A.3 and H.A.4) were accepted statistically with different degrees of correlation as explained above.

5.5 **Stage 2: Testing Equity Theory in Software Engineering**

In this stage, a deductive study was conducted to test the influence of the team member's role on the application of Equity Theory in software engineering on the one hand, and how Equity Theory's components' interact with the Motivational Force level of individuals working in software engineering environments on the other.

5.5.1 **Theoretical Framework**

Equity Theory is considered one of the most important theories of motivation (Thompson & McHugh, 2002). It was developed by Stacey Adams in 1963, based on

Festinger's earlier work on Cognitive Dissonance Theory in 1962. Cognitive Dissonance Theory states that a powerful motive to maintain cognitive consistency can give rise to irrational and sometimes maladaptive behaviour (Festinger, 1962).

The aim of Equity Theory is to understand how people feel that they are "equitably treated." It is based on a set of inputs and outputs that must be in balance to make people feel "equitable." The inputs that people bring into a work context include experience, education, skills and seniority, which should be matched by outputs gained, such as salary, recognition and opportunity for achievement. Workers will compare the balance of their inputs and outputs with that of others. Equity is thus perceived relative to others (Hall et al., 2009).

In software engineering research, Equity Theory was found to be mentioned in a limited number of studies (10 studies) in a systematic review conducted by Hall et al. in 2009. However, only five of these articles mentioned the theory explicitly (Hall et al., 2009).

In conclusion, Equity Theory emphasises the significant importance of individuals' feelings towards two main factors: pay rules and recognition for work performed. Based on the preliminary study conducted in this research (Chapter 4) and the gap in the literature in software engineering, it was decided to conduct an empirical study to investigate the influence of team members' roles on their feelings of equity, and hence, how their motivational force levels could be influenced by differing levels of feelings of equity. This investigation is presented in the study model as shown in Figure 5.6.

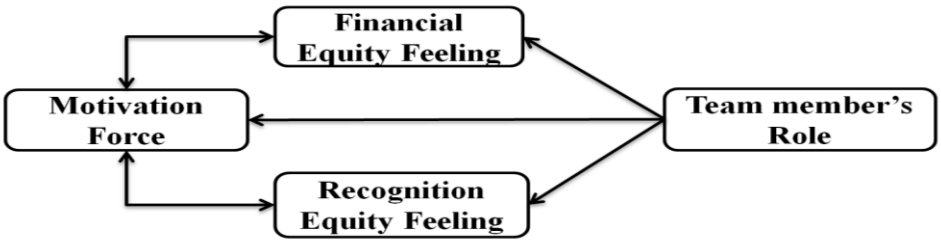


Figure 5.6 Equity Theory Model

The suggested model, as shown in Figure 5.6, utilises the following hypotheses to be tested in this stage:

* * Hypotheses are numbered based on (H.X.Y) form where (H: Hypothesis, X: The group A,B or C. Y: the sequence number of the hypothesis ,1,2,3…)

H.B.1.The Equity Theory element (Recognition Equity and Financial Equity) could be influenced by the role of members in software engineering projects.

H.B.2.The Equity Theory element (Recognition Equity and Financial Equity) are correlated to the level of motivational force for software engineering professionals.

The first hypothesis requires statistical comparison of the means of the two types of equity, based on the type of role the member plays in software engineering projects. Therefore, the parametric measure one-way ANOVA and the non-parametric measure Welch test are applied. However, means comparison test requires the data to meet the following assumptions:

- The dependent variable is normally distributed in all the factor groups.
- The dependent variable does not present significant outliers in any of the factor groups.
- The dependent variable has equal variances in all factor groups (there is homogeneity of variances).

5.5.2 **Normality and Outliers**

Since the sample size is quite large, the analysis of variances will be run regardless of the normality assumption, as the violation of this assumption does not affect the false positive rate (Glass et al. 1972, Harwell et al. 1992, Lix et al. 1996).

Outliers were checked by boxplot diagrams for the three dependent variables and the results showed that there were no influential outliers in this statistical process relative to the size of the sample.

5.5.3 **Homogeneity Test**

Testing the homogeneity of the variances by Levene's test is fundamental in order to determine which types of tests are to be performed (parametric or non-parametric). If the result shows homogeneous variances, the ANOVA test would be the appropriate test, if not then the Welch test would be most appropriate, as it is a non-parametric test for means' comparison. The results of the Levene test for homogeneity of variances can be examined in Table 5.8.

Table 5.8 Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
Financial Equity	.545	2	205	.581
Recognition Equity	1.515	2	205	.222

The assumption of homogeneity of variances is met for the two factors Recognition Equity and Financial Equity, as assessed by the Levene statistic (p=0.581 and p=0.222) respectively. Therefore, the influence of member's roles on their Recognition Equity and Financial Equity factors will be tested by the ANOVA test.

5.5.4 **Means Comparison Tests**

The results of the ANOVA test are presented in Table 5.9.

Table 5.9 ANOVA for Equity Theory

		Sum of Squares	df	Mean Square	F	Sig.
Financial Equity	Between Groups	8.740	2	4.370	3.875	.022
	Within Groups	231.183	205	1.128		
	Total	239.923	207			
Recognition Equity	Between Groups	2.096	2	1.048	.813	.445
	Within Groups	264.322	205	1.289		
	Total	266.418	207			

As shown in Table 5.9, the ANOVA test results for both Recognition and Financial Equity factors revealed that these factors were different in terms of the influence of the independent factors (member's role type).

The Financial Equity factor is seen as having statistically significant differences in level, based on the member's role factor, F (2, 205) =3.875, p=0.02. Since the p-value of the F-test is less than 0.05, the null hypothesis was rejected, and it was found that there was a statistically significant difference between the means for the sample groups' members' roles for the dependent variable level of Financial Equity feeling.

The Recognition Equity factor was seen as not having statistically significant differences in levels based on the member's role factor, F (2, 205) =0.813, p=0.445. Since the p-value of the F-test was higher than 0.05, the null hypothesis was retained by reporting that there was no statistically significant difference between the means of the sample group members' roles for this dependent variable. In other words, regardless of

these participants' roles, they were equal in their feelings about Recognition Equity, whether this level was high or low.

In order to identify which role was different from other roles in terms of their Financial Equity feeling, the LSD test for multiple comparisons was performed and the results are presented in Table 5.10.

Table 5.10 Multiple Comparison of Financial Equity factor

Multiple Comparisons

Dependent Variable		(I) Role	(J) Role	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Financial Equity	LSD	technical work (Dev, design,network..etc)	IT manager	-.446*	.163	.007	-.77	-.12
			Coordination staff	-.025	.246	.920	-.51	.46
		IT manager	technical work (Dev, design,network..etc)	.446*	.163	.007	.12	.77
			Coordination staff	.421	.262	.110	-.10	.94
		Coordination staff	technical work (Dev, design,network..etc)	.025	.246	.920	-.46	.51
			IT manager	-.421	.262	.110	-.94	.10

As shown in Table 5.10, a statistically significant level of differences can be seen between those in technical work and IT managers groups. In other words, technical staff feel (mean=2.33) that they were treated unequally and differ statistically from the IT managers' group (mean=2.78) and were thus not equal in terms of their feelings towards the financial incentives offered to them for their efforts, compared to other groups. Further exploration of these means as shown in Figure 5.7

In conclusion, the IT managers group was statistically different from other groups in terms of their Financial Equity feeling in software engineering projects.

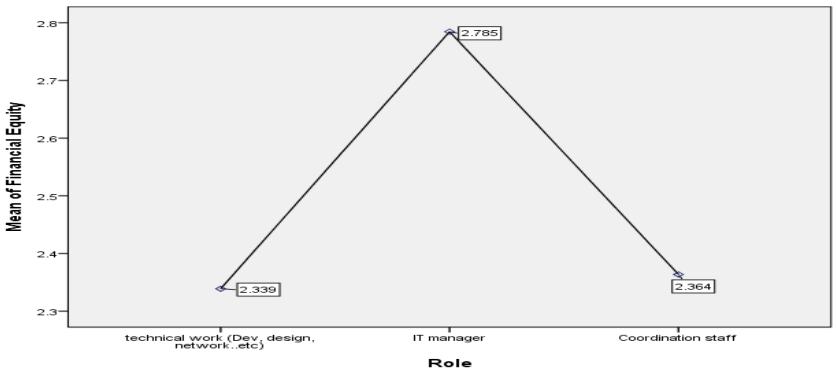


Figure 5.7Means plot

5.5.5 **Correlation Test between Motivational Force and Equity Theory**

A series of correlation analyses were run in order to determine whether there was a significant relationship between the variable "Motivational Force", on the one hand, and the variables Recognition and Financial Equity factors, on the other.

The assumptions that must be checked before running a correlation analysis are:

- The relationship between the variables is approximately linear.
- The variables are approximately normally distributed.
- The variables do not present significant outliers.

In terms of the linearity of the relationship between these variables, the relationship between Motivational Force and Financial Equity, as well as the relationship between Motivational Force and Recognition Equity, could both be described as quite far from being linear, as shown in Figure 5.8 and Figure 5.9, so this may be problematic.

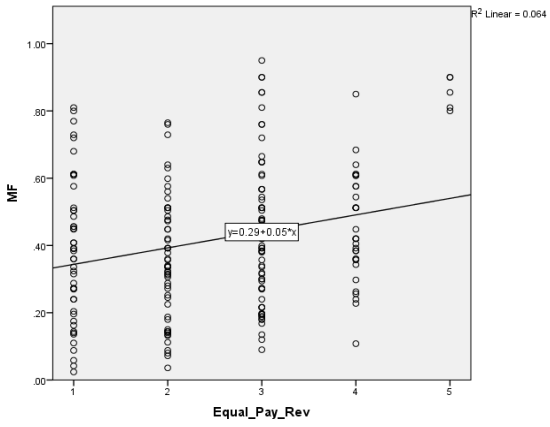


Figure 5.8 Linear test for Financial Equity and MF

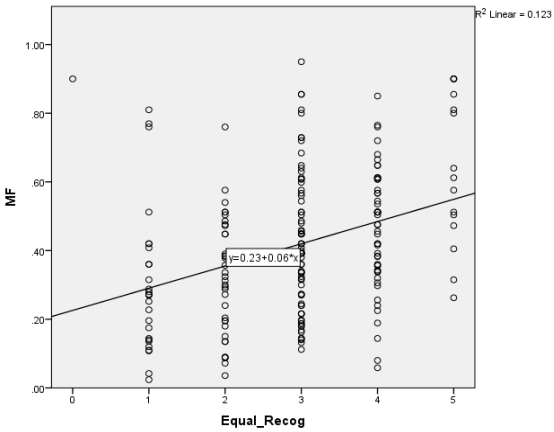


Figure 5.9 Linear test for Recognition Equity and MF

Given the issues related to assumptions 1 and 2, it was decided to perform the Spearman correlation test for these variables as a non-parametric test. The Spearman tests results are shown in Table 5.11.

Table 5.11Correlation test for Equity Theory

Correlations

			Motivation Force	Financial Equity	Recognition Equity
Spearman's rho	Motivation Force	Correlation Coefficient	1.000	.216**	.378**
		Sig. (2-tailed)	.	.002	.000
		N	208	208	208

As shown in Table 5.11, The Spearman test was run and the results reveal that both factors (Financial and Recognition Equity feelings) are positively correlated with the Motivational Force factors, as they show correlation coefficient values (0.216 and 0.378) respectively. Although this correlation could be considered weak, the Financial Equity feeling factor is lower than Recognition Equity in terms of the correlation coefficient value.

Therefore, the results confirm that there are statistical correlations between the Equity Theory factors and level of Motivational Force in software engineering environments.

5.5.6 **Summary of Stage 2**

This study has followed a deductive approach in testing the applicability of Equity Theory in software engineering settings. The results from the inferential analysis have led to the following conclusions:

- The IT managers group is statistically different from other groups in terms of their Financial Equity feeling in software engineering projects.
- There are statistical correlations between the Equity Theory factors and level of Motivational Force in software engineering environments.

In conclusion, the hypotheses (H.B.1and H.B.2) were accepted statistically with a quite weak correlation between Equity Theory items and the Motivational Force level in individuals working in software engineering environments.

5.6 **Stage 3: Testing Goal Setting Theory in Software Engineering**

In this stage, a deductive study was conducted firstly to test the influence of the daily work types on the application of Goal Setting Theory, and secondly how the components of Goal Setting Theory interact with the Motivational Force level of individuals working in software engineering environments.

5.6.1 **Theoretical Framework**

Setting goals refers to the efforts made to clarify goals and make them specific, measurable, achievable, realistic, and time targeted (Blanchard et al., 1985). Goals can be a very useful tool for increasing employees' motivation if they are appropriately organised since there is a strong relationship between goals and performance (Locke & Latham, 2002). The lack of management tools to monitor employees' performance and ensure that they are on the right track during task performance has motivated many

researchers in management and psychology to suggest alternative tools to employing direct coercion by managers. Gutknecht and Miller lists three requirements for goal setting (proper goal definition, specific goals and feedback on progression (Gutknecht & Miller, 1990).

In the software engineering industry, a limited amount of research has been conducted to examine the impact of different goal-setting components on project members' motivational level. Tasks in software engineering are considered highly challenging and require specific types of skills and knowledge.

Accordingly, based on the gap found in the literature and the findings from the preliminary study conducted in this research (Chapter 4), it was decided to conduct an empirical study to investigate the influence of daily work types (Projects and Operations) on the applicability of setting goals in software engineering environments, and how the Motivational Force level in this study's sample could be influenced by differing levels of application of Goal Setting Theory. This investigation is presented in the study model, as shown in Figure 5.10

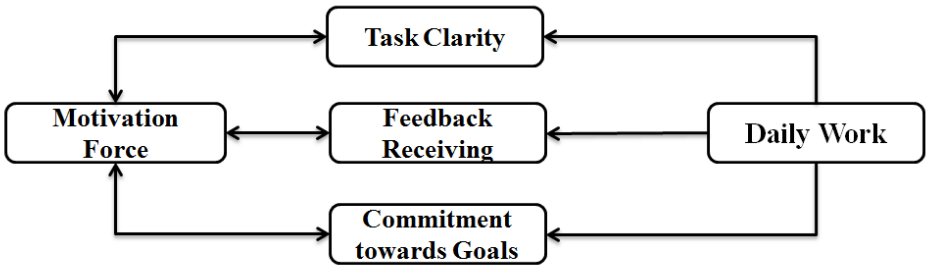


Figure 5.10 Goal Setting Theory model

The suggested model, as shown in Figure 5.10, utilises the following hypotheses to be tested in this stage:

* * Hypotheses are numbered based on (H.X.Y) form where (H: Hypothesis, X: The factors group A,B or C. Y: the sequence number of the hypothesis ,1,2,3…), in this stage the group B hypotheses is being tested. In the previous stage H.B.1 and H.B.2 were tested. The complete list of hypotheses are shown in page 4-84)

H.B.3 Goal-Setting Theory element (task clarity, commitment towards goals and receiving feedback) could be influenced by the type of the daily work of professionals working in software engineering environments.

H.B.4 Goal-Setting Theory element (task clarity, commitment towards goals and receiving feedback) are correlated with the level of motivational force for software engineering professionals.

The first hypothesis requires a statistical comparison of the means of the two types of equity based on the type of role played by the member in software engineering projects. The parametric measurement one-way ANOVA and the non-parametric measurement Welch test are therefore applied. These means' comparison tests require the data to meet the following assumptions:

- The dependent variable is normally distributed in all the factor groups.
- The dependent variable does not present significant outliers in any of the factor groups.
- The dependent variable has equal variances in all factor groups (there is homogeneity of variances).

5.6.2 **Normality and Outliers**

Since the sample size is quite large, the analysis of variances will be run regardless of the normality assumption, as the violation of this assumption does not affect the false positive rate (Glass et al. 1972, Harwell et al. 1992, Lix et al. 1996).

Outliers were checked by boxplot diagrams for the three dependent variables and the results showed that there were no influential outliers in this statistical process relative to the size of the sample.

5.6.3 **Homogeneity Test**

Testing the homogeneity of the variance by Levene's test was fundamental in order to determine which types of tests were to be performed (parametric or non-parametric). If the result showed a homogeneous variance, the ANOVA test would be the appropriate test, if not, the Welch test would be appropriate, as it is a non-parametric test for means' comparison. The results of the Levene test for homogeneity of variances can be examined in Table 5.12.

Table 5.12 Test of Homogeneity of Variances in Goal Setting Theory

	Levene Statistic	df1	df2	Sig.
Task clarity	1.602	2	205	.204
Commitment to the goals	3.473	2	205	.033
Receiving feedback	1.221	2	205	.297

As shown in Table 5.12, the assumption of homogeneity of variances is met by two factors (task clarity and receiving feedback), as assessed by the Levene statistic (p=0.204 and p=0.297) respectively. Therefore, the influence of daily work types on these two factors will be tested by the one-way ANOVA test. In terms of the commitment to the goals factor, it is considered as non-homogeneous, as assessed by the Levene statistic (p=0.033). Therefore, the robust test of equality of means (Welch) will be considered for this factor.

5.6.4 **Means Comparison Tests**

The results of the ANOVA test for the two factors task clarity and feedback receiving are presented in Table 5.13 while the result of the commitment to the goals factor (Welch test) is shown in Table 5.14

Table 5.13 ANOVA test for Goal Setting factors

		Sum of Squares	df	Mean Square	F	Sig.
Task clarity	Between Groups	.160	2	.080	.188	.829
	Within Groups	87.388	205	.426		
	Total	87.548	207			
Receiving feedback	Between Groups	1.329	2	.665	.701	.497
	Within Groups	194.440	205	.948		
	Total	195.769	207			

As shown in Table 5.13, both factors (task clarity and feedback receiving) were seen to be non-significant in relation to the factor daily work types. The results for Task clarity factor were (F (2, 205) =0.188, p=0.829.), while the results of receiving feedback factor were (F (2, 205) =0.701, p=0.497). Since the p-value of the F-test was higher than 0.05, the null hypotheses were accepted by reporting that there were no significant differences between the sample groups' means for daily work type for these dependent variables. In conclusion, the type of daily work (whether it involves projects or operations) does not

appear to influence the amount of feedback received or task clarity level experienced by this sample in the workplace. In other words, all the sample groups seemed to be equal in terms of their feelings towards the level of feedback and task clarity that they experienced in software engineering environments.

Table 5.14 Welch test for Goal Setting factors

		Statistic[a]	df1	df2	Sig.
commitment to goals	Welch	.170	2	73.312	.844
a. Asymptotically F distributed.					

In terms of testing the commitment to the work goals, as shown in Table 5.14, the value of the Welch statistic with 2 and 73.312 degrees of freedom is 0.170, p=0.844. Since the p-value of the F-test is higher than 0.05, the null hypothesis was accepted by reporting that there were no significant differences overall between the means of types of daily work for this dependent variable and commitment towards goals.

In conclusion, the daily work form had no influence on these Goal Setting Theory items. This means that the participants in this sample from all three groups were equal in terms of their feelings towards task clarity, amount of feedback received and the commitment towards their goals, whether their work was dedicated to projects only or for operations in software engineering. Therefore, the hypothesis (H.B.3) was statistically rejected.

5.6.5 **Correlation between Motivational Force and Goal Setting Theory**

A series of correlation analyses were run in order to determine whether there was a significant relationship between the variable "Motivational Force", on the one hand, and the variables task clarity, commitment towards goals and receiving feedback factors, on the other.

The assumptions that must be checked before running a correlation analysis are:

- The relationship between the variables is approximately linear.
- The variables are approximately normally distributed.
- The variables do not present significant outliers.

In terms of the linearity of the relationship between these variables, the relationship between Motivational Force and task clarity, as well as the relationship between Motivational force and commitment towards goals, could be described as being approximately linear, as shown Figure 5.11 and Figure 5.12 , but the relationship

between Motivational Force and Feedback Receiving is quite far from being linear, as shown in Figure 5.13, so it may be problematic.

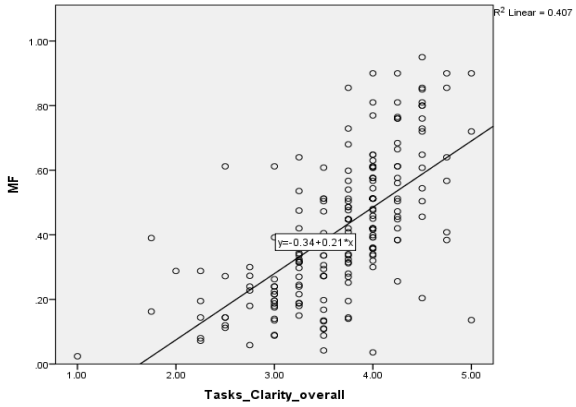


Figure 5.11 Linear test for Task Clarity

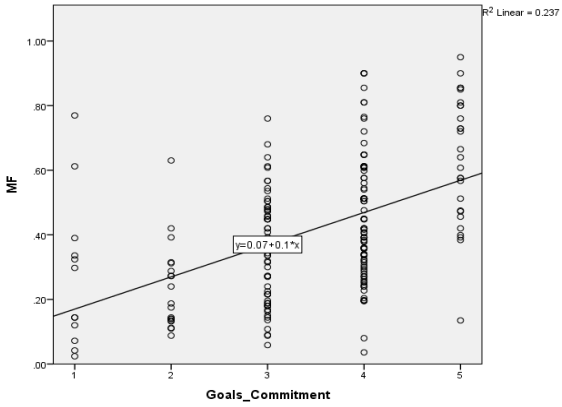


Figure 5.12 Linear test for Commitment towards Goals

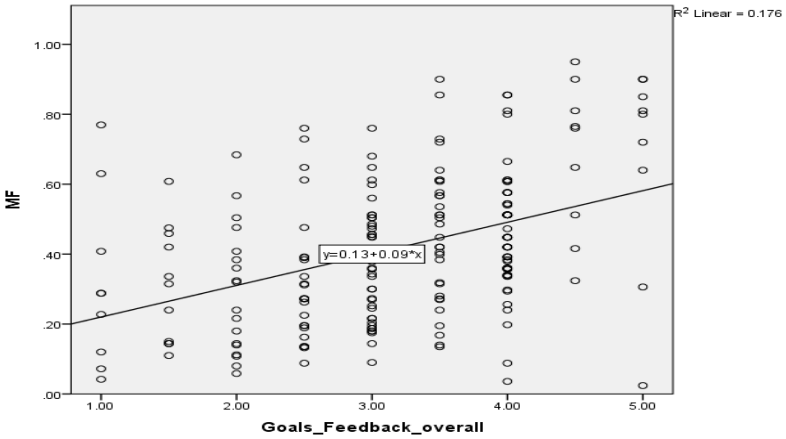


Figure 5.13 Linear test for Feedback factor

Given the issues related to the assumptions of linearity and normality, it was decided to run the Spearman correlation test for these variables as a non-parametric test. The results of the Spearman Correlation analysis, as presented in Table 5.15, reveal a significant correlation level between the Motivational Force factor and the three components of Goal Setting Theory. The Spearman correlation coefficient values for the factor task clarity is (0.680, $p<0.0005$), and for commitment towards goals (0.492, $p<0.0005$), and for receiving feedback (0.420, $p<0.0005$). Therefore there are significant correlations between the variables in the total population.

Table 5.15 Spearman's rho Correlation test

		the Motivational Force
Task clarity	Correlation Coefficient	.680**
	Sig. (2-tailed)	.000
	N	208
Commitment to goals	Correlation Coefficient	.492**
	Sig. (2-tailed)	.000
	N	208
Receiving feedback)	Correlation Coefficient	.420**
	Sig. (2-tailed)	.000
	N	208

Therefore, the results confirm that there are statistical correlations between Goal Setting Theory factors and level of Motivational Force in software engineering environments.

5.6.6 **Summary of Stage 3**

This study has followed a deductive approach to testing the applicability of Goal Setting Theory in software engineering settings. The results from the inferential analysis have led to the following conclusions:

- Individuals in software engineering environments are equal in terms of their feeling towards the task clarity, amount of feedback received and the commitment towards their goals, whether their work is dedicated to projects only or for operations in software engineering.
- The level of the Motivational Force in individuals working in software engineering is correlated positively with the applicability of Goal Setting Theory in software engineering environments.

In conclusion, the hypotheses of this stage (H.B.3 and H.B.4) were tested statistically. The results rejected H.B.3 and accepted H.B.4 statistically, with a moderate to high correlation between Goal Setting Theory items and the level of Motivational Force in software engineering environments.

5.7 **Stage 4: Testing Self-Determination Theory in Software Engineering**

In this stage, a deductive study was conducted to firstly test the influence of contract types on the level of Self-Determination Theory's components (intrinsic and extrinsic motivators), and secondly how the components of Self-Determination Theory interact

with the Motivational Force level of individuals working in software engineering environments.

5.7.1 **Theoretical Framework**

Self-Determination Theory (SDT) is a theory of motivation which is concerned with supporting the natural or intrinsic tendencies to behave in effective and healthy ways. SDT has been researched and practised by a network of researchers around the world. This theory developed by Deci and Ryan in 1984 has been elaborated and refined by scholars from many countries in a diversity of research fields, but it was found in the literature review that only limited studies have been conducted in the software engineering field. Furthermore, SDT provides a profound insight into the internal and external drivers of an individual's motivation through two categories of motivation: intrinsic, and extrinsic. These components have been tested broadly in various fields such as education, health and sports. However, testing these components in the software engineering industry could increase the understanding of their achievability and how these components vary from one field to another. Since STD postulates job restrictions and work environments, contract types are suggested to be an influential factor on these components, as shown in Figure 5.14.

In order to measure intrinsic motivation level, the Intrinsic Motivation Inventory (IMI) was used in this research, as it has been used in several experiments related to intrinsic motivation and self-regulation. However, The Intrinsic Motivation Inventory (IMI) was adjusted slightly to match the characteristics of the software engineering business, and then adopted to measure the participants' intrinsic motivation level.

Extrinsic motivation is measured in this research by adopting the Behavioural Regulation In Exercise Questionnaire (BREQ) (Mullan, Markland & Ingledew, 1997), this tool was developed based on Deci & Ryan's (1985, 1991) conception of a continuum of extrinsic and intrinsic motivation. A further modification was performed to the BREQ in order to cover the main factors that could motivate individuals extrinsically.

Although BREQ-2 was designed and tested primarily in the sport and health sectors, software engineering activities also require highly motivated individuals to perform its activities in an efficient manner, and the association between a performer's motivation level and the type of extrinsic motivation driver that influences a person could increase

the understanding of how professionals in software engineering could be motivated extrinsically.

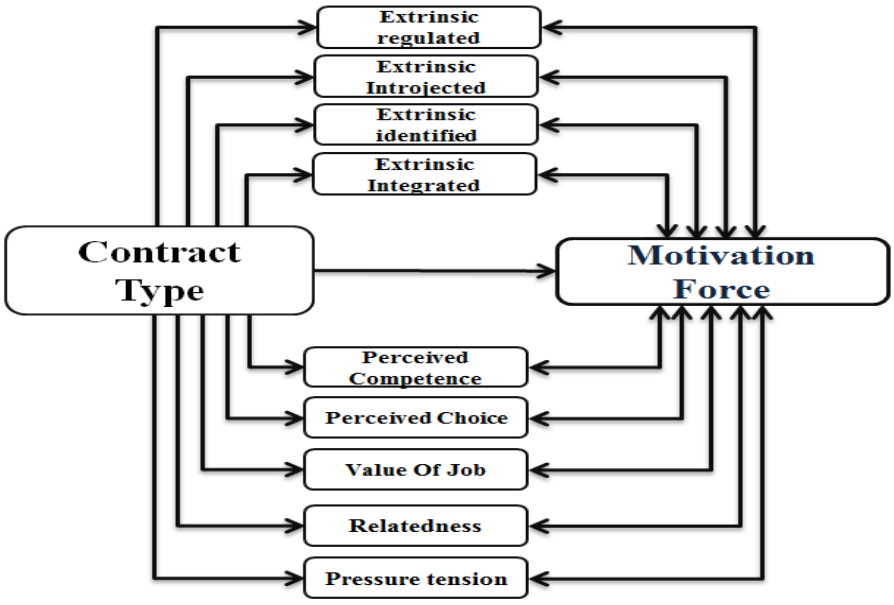


Figure 5.14 SDT Theory model

The suggested model, as shown in Figure 5.14, utilises the following hypotheses to be tested in this stage:

* * Hypotheses are numbered based on (H.X.Y) form where (H: Hypothesis, X: The factors group A,B or C. Y: the sequence number of the hypothesis ,1,2,3…), In this stage B group's hypotheses are tested. In the previous three stages H.B.1 to H.B.4, were tested. The complete list of hypotheses are shown in page 4-84)

H.B.5 The type of employment contract could predict the level of motivational force of software engineering professionals.

H.B.6 Intrinsic motivation could be influenced by the type of employment contract in software engineering environments.

H.B.7 Extrinsic motivation could be influenced by the type of employment contract in software engineering environments.

H.B.8 Intrinsic motivation is correlated with the level of motivational force for software engineering professionals.

H.B.9 Extrinsic motivation is correlated with the level motivational force for software engineering professionals.

5.7.2 **Normality and Outliers**

Since the sample size is quite large, the analysis of variances will be run regardless of the normality assumption, as the violation of this assumption does not affect the false positive rate (Glass et al. 1972, Harwell et al. 1992, Lix et al. 1996).

Outliers were checked by boxplot diagrams for the three dependent variables and the results show that there were no influential outliers in this statistical process relative to the size of this sample.

5.7.3 **Homogeneity Test**

Testing the homogeneity of the variances by Levene's test was fundamental in order to determine which types of tests were to be performed (parametric or non-parametric). If the results showed homogeneous variances, then the ANOVA test would be the appropriate test, if not, then the Welch test would be appropriate, as it is a non-parametric test for means' comparison. The results of the Levene test for homogeneity of variances can be examined in Table 5.16.

Table 5.16 Test of Homogeneity of Variances of SDT by contract types

		Levene Statistic	**df1**	**df2**	**Sig.**
Intrinsic	Perceived Competence	.461	4	203	.765
	Pressure Tension	1.631	4	203	.168
	Perceived Choice	1.783	4	203	.134
	Value Of Job	.997	4	203	.410
	Relatedness	1.273	4	203	.282
the Motivational Force		.936	4	203	.444
Extrinsic	External regulation	.372	4	203	.829
	Introjected regulation	.181	4	203	.948
	Identification	1.506	4	203	.202
	Integrated regulation	1.495	4	203	.205

As shown in Table 5.16, all the variances of the dependent factors are homogeneous and valid to be tested by the parametric test ANOVA since all their p-values are greater than 0.05.

5.7.4 **Means Comparison Tests**

The ANOVA test was performed to compare these groups' means (different contract types) in terms of their levels for the ten dependent factors (five intrinsic, four extrinsic and Motivation Force). The results of the ANOVA test are shown in Table 5.17.

Table 5.17 ANOVA test for SDT by contract types

		Sum of Squares	df	Mean Square	F	Sig
Perceived Competence	Between Groups	0.368	4	0.092	0.206	0.935
	Within Groups	90.628	203	0.446		
	Total	90.995	207			
Pressure Tension	Between Groups	4.157	4	1.039	0.729	0.573
	Within Groups	289.300	203	1.425		
	Total	293.457	207			
Perceived Choice	Between Groups	5.710	4	1.428	1.579	0.181
	Within Groups	183.554	203	0.904		
	Total	189.264	207			
Value of Job	Between Groups	2.173	4	0.543	1.006	0.405
	Within Groups	109.592	203	0.540		
	Total	111.764	207			
Relatedness	Between Groups	0.988	4	0.247	0.621	0.648
	Within Groups	80.730	203	0.398		
	Total	81.717	207			
Motivational Force	Between Groups	0.235	4	0.059	1.353	0.252
	Within Groups	8.835	203	0.044		
	Total	9.070	207			
External regulation	Between Groups	.996	4	.249	.193	.942
	Within Groups	261.311	203	1.287		
	Total	262.308	207			
Introjected regulation	Between Groups	2.554	4	.639	.721	.579
	Within Groups	179.888	203	.886		
	Total	182.442	207			
Identification	Between Groups	1.502	4	.376	.763	.551
	Within Groups	99.954	203	.492		
	Total	101.457	207			
Integrated regulation	Between Groups	8.530	4	2.132	3.521	.008
	Within Groups	122.927	203	.606		
	Total	131.457	207			

As shown in Table 5.17, the results for these intrinsic factors revealed that the contract type factor did not show any significant differences between the groups in this research sample in terms of their intrinsic and extrinsic motivation, except for the factor integrated regulation (p value= 0.008), which meant that the groups in the sample were significantly different based on their contract type in this factor (integrated regulation external motivation).

Nine out of the ten tested factors showed a p-value>0.05. Since the p-value of the F-test was greater than 0.05, the null hypothesis was retained by reporting that there was no statistically significant difference between the sample groups' (contract types) means for the dependent variables. In other words, regardless of the participants' contract types, they were equal in terms of their feelings towards these nine factors.

Testing the integrated regulation factor gave an F value (4,203) = 3.521, and p-value=0.008. Since the p-value of the F-test was less than 0.05, the null hypothesis was rejected by reporting that there was a statistically significant difference between the sample groups' (contract types) means in terms of their integrated regulation level. This indicated that, based on the participants' contract types, they are motivated differently by the degree to which they value other people's performance at work, whether this level of feeling was high or low in its intensity.

A further multiple comparisons (post-hoc) test was performed to identify where this significant difference between groups with different contract types took place. The results show:

- Participants who worked for the government and had signed a permanent contract showed statistically different levels in their level of integrated regulation to those working under annually-based contracts (p=0.012) or in the private business group (p=0.001).
- Participants who signed project-based contracts showed statistically different levels of integrated Regulation from participants who owned their business (p=0.022).

In conclusion, the type of contract had an influence on only one factor of the participants' extrinsic motivation (integrated regulation), where the participants differed in terms of the degree of valuing others' performance and commitment towards work.

The multiple comparisons revealed that these differences were observed between those with governmental and annual-based contracts, those under governmental contracts and private business owners, and also between those in project-based contracts who owned their own business.

Based on the results of the ANOVA test, this stage's hypotheses (H.B.5 and H.B.6) were rejected statistically, as the contract type factor had no influence on either the Motivational Force factor or any intrinsic motivation factor. However H.B.7 was accepted partially as only one component of extrinsic motivation factors (integrated regulation) has shown significant differences among this sample's groups (for contract type).

5.7.5 **Correlation Test between the Motivational Force and SDT Theory**

A series of correlation analyses were run in order to determine whether there was a significant correlation between the variable "Motivational Force", on the one hand, and SDT theory components (intrinsic and extrinsic motivators), on the other.

The assumptions that must be checked before running a correlation analysis are:

- The relationship between the variables is approximately linear.
- The variables are approximately normally distributed.
- The variables do not present significant outliers.

In terms of the linearity assumption, the relationship between Motivational Force, on the one hand, and five intrinsic motivation factors (Perceived Competence, Pressure Tension, Perceived Choice, Value of the Job and Relatedness), on the other, could be described as quite far from being linear, as shown in Figures 5.15 to 5.22, suggesting that the parametric correlation test may be problematic.

Given the issues related to the assumptions of linearity and normality, it was decided to perform the Spearman correlation test for these variables as a non-parametric test. The results of the Spearman correlation test are presented separately for intrinsic and extrinsic motivation factors.

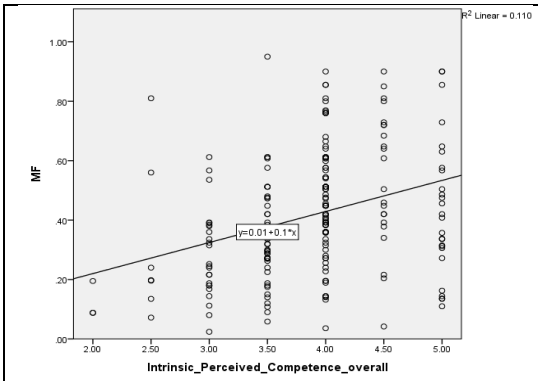


Figure 5.15 Linear test of Perceived Competence

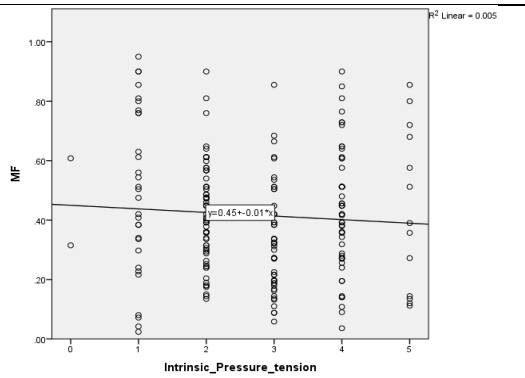


Figure 5.16 Linear test of Pressure Tension level

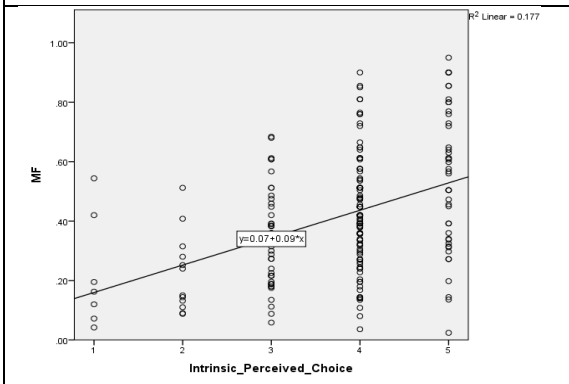


Figure 5.17 Linear test of Perceived Choice

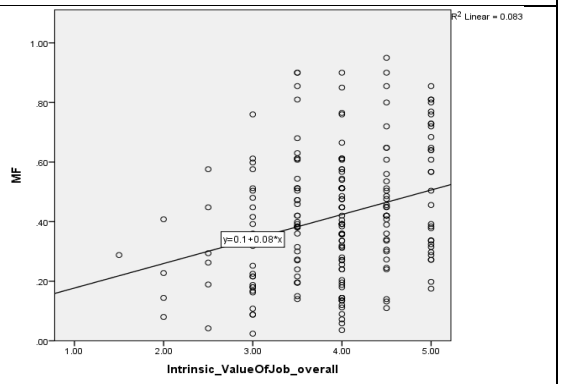


Figure 5.18 Linear test of the Value of the Job

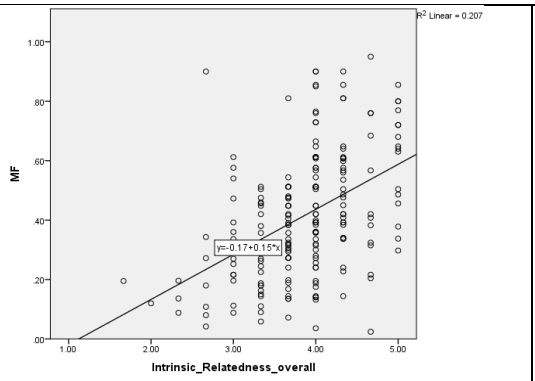


Figure 5.19 Linear test of Relatedness factor

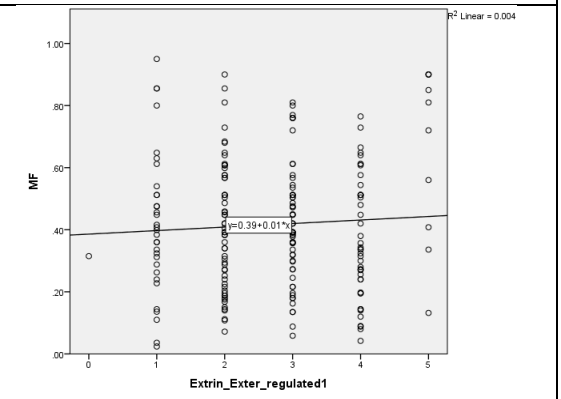


Figure 5.20 Linear test for External Regulation

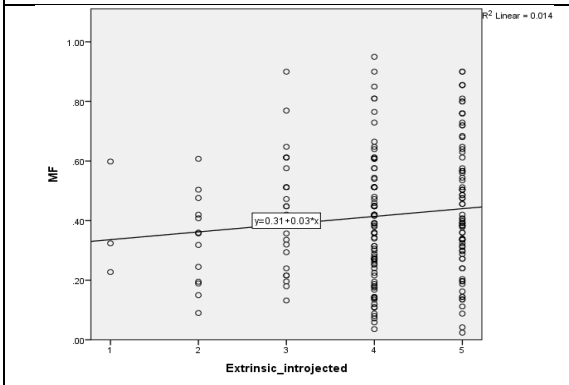


Figure 5.21 Linear test for Introjected Regulation

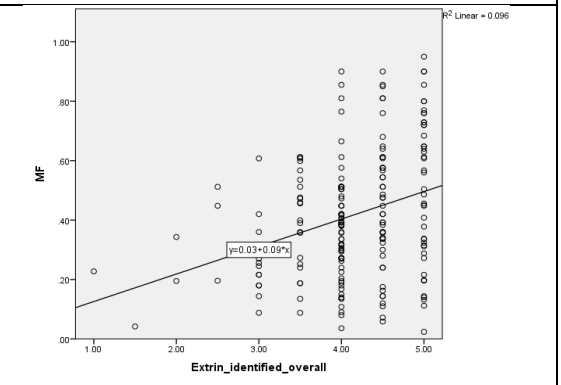


Figure 5.22 Linear test for Identification

Table 5.18 Spearman Correlation test for intrinsic motivation

		Motivational Force	Perceived Competence	Pressure Tension	Perceived Choice	Value Of the Job	Relatedness
Motivational Force	Correlation Coefficient	1.000	.351**	-.066	.402**	.262**	.465**
	Sig. (2-tailed)		.000	.342	.000	.000	.000
	N	208	208	208	208	208	208
Perceived Competence	Correlation Coefficient	.351**	1.000	.043	.232**	.224**	.319**
	Sig. (2-tailed)	.000		.534	.001	.001	.000
	N	208	208	208	208	208	208
Pressure Tension	Correlation Coefficient	-.066	.043	1.000	-.090	.076	-.164*
	Sig. (2-tailed)	.342	.534		.198	.276	.018
	N	208	208	208	208	208	208
Perceived Choice	Correlation Coefficient	.402**	.232**	-.090	1.000	.284**	.406**
	Sig. (2-tailed)	.000	.001	.198		.000	.000
	N	208	208	208	208	208	208
Value Of the Job	Correlation Coefficient	.262**	.224**	.076	.284**	1.000	.446**
	Sig. (2-tailed)	.000	.001	.276	.000		.000
	N	208	208	208	208	208	208
Relatedness	Correlation Coefficient	.465**	.319**	-.164*	.406**	.446**	1.000
	Sig. (2-tailed)	.000	.000	.018	.000	.000	
	N	208	208	208	208	208	208

As shown in Table 5.18, Spearman's test was performed for the five intrinsic motivation factors and revealed some interesting results, as follows:

1. The Motivational Force level showed a positive association with four of the intrinsic motivation factors (Perceived Competence, Perceived Choice, Value of the Job and Relatedness). Although the Pressure Tension factor showed no significant correlation with the level of Motivational Force, it did show a slightly negative correlation (r = -0.66): This could be interpreted as implying that the Motivational Force would be reduced by increasing the Pressure Tension level in software engineering environments. However, Relatedness and Perceived Choice are the two factors most highly correlated with motivational force (r = 0.465 and r = 0.402 respectively)
2. The Perceived Competence factor showed a positive association with four other factors: Motivational Force, Perceived Choice, Value of the Job and Relatedness. The two most highly correlated factors were Motivational Force (r= 0.351) and Relatedness (r=0.319).

3. The Pressure Tension factor did not show any statistically significant correlation with any of the other factors (Motivational Force, Perceived Competence, Perceived Choice, Value of the Job and Relatedness). Nevertheless, it showed a slightly negative correlation with three of the study factors: Motivational Force (r=-0.66) , Perceived Choice(r= - 0.90) and Relatedness (r = -0.164)
4. The Perceived Choice factor showed a positive association with four other factors (Motivational Force, Perceived Competence, Value of the job and Relatedness). The two most highly correlated factors were the Motivational Force (r= 0.402) and relatedness (r=0.402).
5. The Value of the Job factor shows a positive association with four other factors (Motivational Force, Perceived Choice, Perceived Competence and Relatedness), of which the two most highly correlated factors are Perceived Choice (r= 0.284) and Relatedness (r=0.446).
6. The Relatedness factor showed a positive association with four other factors (the Motivational Force, Perceived Choice, Perceived Competence and Value of the Job), the two highest correlations being with the Motivational Force (r= 0.465) and Value of the Job (r=0.446). However, Pressure Tension showed a slightly negative correlation with Relatedness (r = -0.164), which was the highest negative correlation coefficient value.

In conclusion, four out of the five intrinsic motivational factors (Perceived Choice, Perceived Competence, Value of the Job and Relatedness), showed a statistical positive correlation with the value of the Motivational Force, and one factor (Pressure Tension) had a slightly negative correlation with the Motivational Force value. Therefore, the research hypothesis H.B.8 was accepted statistically.

Table 5.19 Spearman Correlation test for intrinsic motivation

		Motivational Force	Externally regulated	Introjected regulation	Identification	Integrated regulation
Motivational Force	Correlation Coefficient	1.000	.025	.104	.277**	.158*
	Sig. (2-tailed)	.	.718	.135	.000	.023
	N	208	208	208	208	208
Externally regulated	Correlation Coefficient	.025	1.000	-.002	.049	-.013
	Sig. (2-tailed)	.718	.	.982	.486	.850
	N	208	208	208	208	208
Introjected regulation	Correlation Coefficient	.104	-.002	1.000	.373**	.357**
	Sig. (2-tailed)	.135	.982	.	.000	.000
	N	208	208	208	208	208
Identification	Correlation Coefficient	.277**	.049	.373**	1.000	.488**
	Sig. (2-tailed)	.000	.486	.000	.	.000
	N	208	208	208	208	208
Integrated regulation	Correlation Coefficient	.158*	-.013	.357**	.488**	1.000
	Sig. (2-tailed)	.023	.850	.000	.000	.
	N	208	208	208	208	208

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

As shown in Table 5.19, the Spearman correlation test reveals several correlations as follows:

1. The Motivational Force level had a positive correlation with only two extrinsic motivation factors (Identification and Integrated Regulation), with correlation coefficient values ($p<0.0005$, $r=.277$) and ($p=0.023$, $r=0.158$) respectively.
2. The Externally Regulated factor showed no significant level of correlation with any other factors in this test.
3. The introjected Regulation factor showed positive correlations with two factors (Identification and Integrated Regulation) with correlation coefficient values of ($p<0.0005$, $r=0.373$) and ($p<0.0005$, $r=0.353$) respectively.

4. The Identification factor showed positive correlations with three factors (the Motivational Force, Introjected Regulation and Integrated Regulation), with correlation coefficient values of ($p<0.0005$, $r=.277$), ($p<0.0005$, $r= 0.373$) and ($p<0.0005$, $r=0.488$) respectively.
5. Integrated Regulation showed positive correlations with three factors (the Motivational Force, Introjected Regulation and Identification), with correlation coefficient values ($p=0.023$, $r=.158$), ($p<0.0005$, $r= 0.357$) and ($p<0.0005$, $r=0.488$), respectively.

In summary, four extrinsic motivation factors were examined using the Spearman correlation test, therefore, the research hypothesis H.B.9 was statistically accepted, as the results showed that only two out of the four extrinsic motivational factors (Identification and Integrated Regulation) exhibited a statistical positive correlation with the level of the Motivational Force.

5.7.6 **Summary of Stage 4**

This stage followed a deductive approach to testing the applicability of Self-Determination Theory in software engineering settings. The results from the inferential analysis showed the following conclusions:

- The contract type factor had no statistical influence on the participants' intrinsic motivation level.
- The Motivational Force level was found to be statistically correlated to four out of the five selected intrinsic motivational factors (Perceived Choice, Perceived Competence, Value of the Job and Relatedness), whereas the fifth factor (Pressure Tension) showed a slightly negative correlation with the Motivational Force Value.
- The type of contract had an influence on the participants' extrinsic motivation in only one extrinsic motivational factor (Integrated Regulation).
- The Motivational Force level of these participants was found to be correlated positively with two out of the four extrinsic motivational factors (Identification and Integrated Regulation).

5.8 Stage 5: Testing Organisational Commitment Theory in SE

In this stage, a deductive study was conducted to test the influence of contract types on the level the components of Organisational Commitment Theory and how these components' interacted with the Motivational Force level of individuals working in software engineering environments.

5.8.1 Theoretical framework

Organisational commitment has been defined over the years in different ways, based on the nature of the relationship between the two commitment poles, employees and organisation (Coetzee, 2005). According to O'Reilly & Chatman (1986) "Commitment is the psychological attachment felt by the person towards the organisation". Organisational commitment could be classified based on different theoretical purposes and perspectives. However, the most commonly accepted theory used was introduced by Meyer and Allen in 1991 and has been used in many organisational commitment studies. Mayer and Allen categorised commitment into three main themes: 1) Affective Commitment 2) Continuance Commitment 3) Normative Commitment. Each theme explains the employee's permanence within the current organisation (Meyer & Allen, 1991). Firstly, affective commitment could be attributed to the strong emotional relationship between an employee and his or her organisation. Employees with a strong affective commitment are likely to stay at their organisations longer than those without. Secondly, continuance commitment refers to the cost estimation of leaving the current job and looking for another, 'better' position. It considers the time and effort required to build new skills and relationships, as well as other factors. Finally, normative commitment could occur through an employee's obligation to remain at an organisation, due to issues such as responsibility and binding conditions such as family, culture or even the monetary reward system. For example, insurance, loans and housing (Coetzee, 2005).

Based on the limited studies that have been conducted in software engineering environments, with regard to organisational commitment, a model was developed, as shown in Figure 5.23, to be tested in software engineering environments.

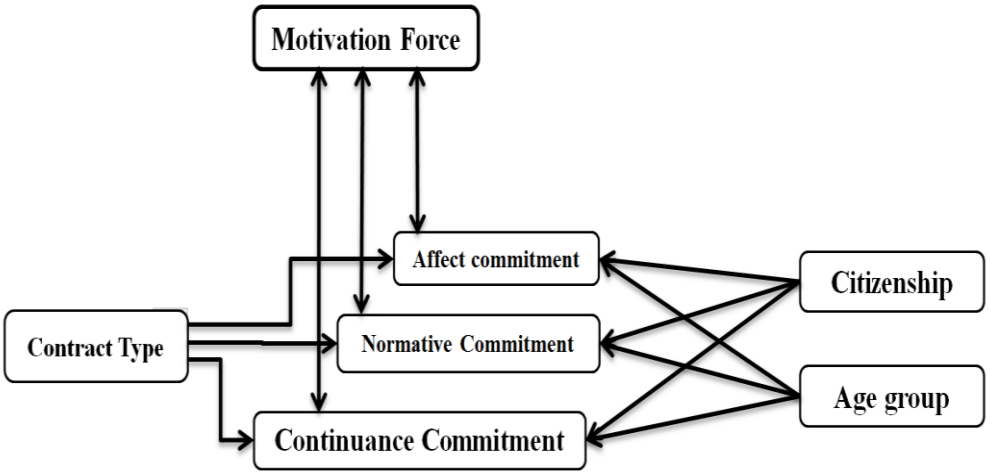


Figure 5.23Organisational Commitment model

Based on the proposed model the research hypotheses will be as follows:

* * Hypotheses are numbered based on (H.X.Y) form where (H: Hypothesis, X: The factors group A,B or C. Y: the sequence number of the hypothesis ,1,2,3…), In this stage C group hypotheses were tested. In the previous four stages groups A and B were tested. The complete list of hypotheses are shown in page 4-85).

H.C.1 Contract types have an impact on the three components of the Organisational Commitment (Affective, Normative and Continuance) in software engineering environments.

H.C.2 Age groups have an impact on the three components of the Organisational Commitment (Affective, Normative and Continuance) in software engineering environments.

H.C.5. H.C.3 Citizenship status has an impact on the three components of the Organisational Commitment (Affective, Normative and Continuance) in software engineering environments.

H.C.6. Organisational commitment is correlated with the Motivational Force level for individuals working in software engineering environments.

H.C.4 Organisational commitment is correlated with the Motivational Force level for individuals working in software engineering environments.

5.8.2 **Normality and Outliers**

Since the sample size is quite significant, the analysis of variances is run regardless of the normality assumption, as the violation of this assumption does not affect the false positive rate (Glass et al. 1972, Harwell et al. 1992, Lix et al. 1996).

Outliers were checked by boxplot diagrams for the three dependent variables and the results showed that there were no influential outliers in this statistical process relative to the size of the sample.

5.8.3 **Homogeneity test**

Testing the homogeneity of the variances by Levene's test was fundamental in order to determine which type of tests should be performed (parametric or non-parametric). If the results showed homogenous variances, the ANOVA test would be the appropriate test, if not, then the Welch test was appropriate, as it is a non-parametric test for means comparison. The results of the Levene test for homogeneity of variances could be examined in three steps, as each step is concerned with different independent factors.

Table 5.20 Levene's Test of Homogeneity

Test of Homogeneity of Variances over Contract types				
	Levene Statistic	df1	df2	Sig.
Affective Commitment	1.665	4	203	.159
Continuance Commitment	1.040	4	203	.388
Normative Commitment	.813	4	203	.518
Test of Homogeneity of over age groups				
Affective Commitment	.880	4	203	.477
Continuance Commitment	.904	4	203	.463
Normative Commitment	1.024	4	203	.396

As shown in Table 5.20, all the variances of the dependent factors were homogeneous over the two independent factors contract type and age group and are thus valid to be tested by the parametric ANOVA test since all their values are greater than 0.05.

The result of Levene's test for citizenship was combined with the independent t-test, as the citizenship factor had only two categorical levels (local worker, expatriate).

5.8.4 **Means Comparison Tests**

In this stage, the influences of three independent factors (contract type, age group and citizenship status) were examined inferentially against the components of organisational commitment as identified by Myer and Allen (1991). A Means comparison was measured by different types of statistical tests, based on the number of each factor's categories. The first two factors (contract type and age group) was examined by the ANOVA test, as there are more than two levels in these categories, while citizenship status has only two levels (local and expatriate). Therefore, it will be examined by a t-test.

5.8.4.1 ANOVA Test for Age Group and Contract Type

Table 5.21 ANOVA test for Organisational Commitment

		Sum of Squares	df	Mean Square	F	Sig.
Contract type factor						
Affective Commitment	B. Groups	8.295	4	2.074	2.309	0.059
	W. Groups	182.290	203	.898		
	Total	190.585	207			
Continuance Commitment	B. Groups	3.004	4	.751	.925	0.450
	W. Groups	164.807	203	.812		
	Total	167.812	207			
Normative Commitment	B. Groups	8.163	4	2.041	2.708	0.031
	W. Groups	152.990	203	.754		
	Total	161.153	207			
Age group						
Affective Commitment	B. Groups	12.330	4	3.083	3.511	.009
	W. Groups	178.254	203	.878		
	Total	190.585	207			
Normative Commitment	B. Groups	2.743	4	.686	.879	.478
	W. Groups	158.410	203	.780		
	Total	161.153	207			
Continuance Commitment	B. Groups	14.294	4	3.573	4.725	.001
	W. Groups	153.518	203	.756		
	Total	167.812	207			

As shown in Table 5.21, the results are as follows:

1. **Contract Type factor**: the ANOVA test showed that one out of the three organisational commitment components was statistically significant based on the contract types, which is the Normative Commitment, where F (4, 203) =2.708, and p=0.031. Since the p-value of the F-test was less than 0.05, the null hypothesis was rejected and there was a significant difference between the sample groups' (contract types) means for the dependent variable Normative Commitment. Thus the groups in this sample were not equal in their Normative Commitment levels towards their organisations in software engineering environments, based on the type of their contracts. However, for the other two components (Affective Commitment and Continuance Commitment) the groups did not show any significant difference as the p-values were greater than 0.05 (0.059 and 0.450 respectively).

   A further multiple comparison tests (post hoc test) for groups' means was performed in order to identify where the differences in Normative Commitment took place amongst the different types of contracts among the participants in this study. The results revealed a significant level of statistical differences between those with project-based contracts and both the government permanent and annually based contract groups. Both tests, LSD and Bonferroni, recorded a p-value less than 0.05. However, LSD values were (p=0.002) between projects and permanent contracts, and p=0.015 between projects and annual contracts. In other words, in project-based contracts, the holders had a greater sense of obligation to remain with an organisation than those in the two other groups (permanent government and annually based contracts). Therefore, this stage's hypothesis H.C.1 was accepted in only one type of commitment (Normative Commitment).

2. **Age Group Factor**: the ANOVA test shows that two out of the three organisational commitment components are statistically significant based on the contract types. These are: Affective Commitment (F (4, 203) =3.511 and p=0.009) and Continuance Commitment (F (4, 203) =4.725 and p=0.001). Since the p-value of the F-test is less than 0.05, I reject the null hypothesis by reporting that there are significant differences between the sample groups' (contract types) means for the dependent variables, Affective Commitment and Continuance Commitment. This meant the groups in this study's sample were

not equal in their Affective and Continuance Commitment levels towards their organisations in software engineering environments, depending on their type of contract. In contrast, the other component (Normative Commitment) did not show a significant level as the p-values=0.0478, which was greater than 0.05.

A further multiple comparison tests (post-hoc test) for groups' means was performed in order to identify where the differences in Affective and Continuance Commitment had taken place among the different age groups in this sample. The results revealed that a significant level of statistical differences occured among many age groups in the two dependent variables (Affective and Continuance Commitment). These differences will be explained as follows:

- Continuance Commitment: the significant differences are between the following groups:
    a. 18-24 group and 45-54 group with LSD P-value = 0.008
    b. 25-34 group and 35-44 group with LSD P-value= 0. 023
    c. 25-34 group and 45-54 group with LSD P-value < 0. 0005
    d. 35-44 group and 45-54 group with LSD P-value= 0.003
    e. 45-54 group and 55-64 group with LSD P-value= 0.023.
- Affective Commitment: the significant differences are between the following three groups:
    a. 18-24 group and 45-54 group with LSD P-value = 0.001.
    b. 25-34 group and 45-54 group with LSD P-value = 0.002.
    c. 35-44 group and 45-54 group with LSD P-value= 0.003.

Based on the multiple comparison tests explained above, it was clear that most of the significant differences occurred between the 45-54 age group and the younger groups, for both the Affective and Continuance Commitment factors. This may be a clear indication of how this study's sample could be categorised into two groups, based on Generation X and Y theory, according to the study conducted by Kian et al. (2012). Therefore, hypothesis H.C.2 was accepted at age groups 45-54 in two types of commitment Affective and Continuance.

5.8.4.2 T-test for citizenship factor

Table 5.22 t-test for citizenship factor

		F	Sig	t	df	Sig	Mean Diff
Affective Commitment	Equal variances	7.038	.009	.132	206	.895	.01937
	Not Equal Var			.120	90.821	.905	.01937
Continuance Commitment	Equal variances	.012	.914	2.321	206	.021	.31652
	Not Equal Var			2.309	108.116	.023	.31652
Normative Commitment	Equal variances	.032	.857	-2.512	206	.013	-.33491
	Not Equal Var			-2.497	107.953	.014	-.33491

As shown Table 5.22, a t-test was performed to find out the influence of the citizenship status of this study's sample on their organisational commitment. Levene's test for groups' variances equality shows that two types of the organisational commitment (Continuance and Normative Commitment) were not homogeneous, since p value=0.009 as this level was less than 0.05. Therefore the t-test results will be driven from equal variances, not assumed computation results, whereas for the Affective Commitment component t-test results would be driven from Equal variances.

The results of the t-test revealed that two types of organisational commitment (Continuance and Normative Commitment) were influenced by the independent factor citizenship, as they had p-values of (0.021 and 0.013) respectively. This meant that people in software engineering projects were not equal in terms of their Continuance and Normative Commitment towards their organisations, based on their citizenship status. However, the Affective Commitment component did not show a statistically significant level of difference between the Citizenship factor groups (p =0.905). Since the results of the t-test were greater than 0.05, there was no significant statistical difference between the two groups (citizens and non-citizens) in terms of their Affective Commitment towards their organisations. Thus, people in software engineering projects were equal in terms of their Affective Commitment towards their organisations, regardless of their citizenship status. Therefore, H.C.3 hypothesis was accepted for two types of commitment (Continuance and Normative).

5.8.5 Correlation between the Motivational Force and Organisational Commitment

A series of correlation analyses were run to determine whether there was a significant correlation between the variable "Motivational Force" and the three components of Organisational Commitment (Affective, Normative and Continuance Commitment).

The assumptions that must be checked before running a correlation analysis are:

- The relationship between the variables is approximately linear.
- The variables are approximately normally distributed.
- The variables do not present significant outliers.

In terms of the linearity assumption, the relationship between motivation force and the three Organisational Commitment components (Affective, Normative and Continuance Commitment) could be described as quite far from being linear, as shown in Figures 5.24 to 5.26, suggesting that the parametric correlation test may be problematic.

Given the issues related to the assumptions of linearity and normality, it was decided to perform the Spearman correlation test for these variables, as a non-parametric test.

The results of the Spearman Correlation analysis are presented in

Table 5.23. The results of Spearman's test for the three organisational commitment factors reveals that all the three Organisational Commitment components (Affective, Normative and Continuance Commitment) are positively correlated with the Motivational Force level. Affective Commitment ($r=0.495$, $p<0.005$) and Normative Commitment ($r=0.492$, $p<0.005$) show higher levels of correlation to the Motivational Force than does Continuance Commitment ($r=0.151$, $p=0.029$).

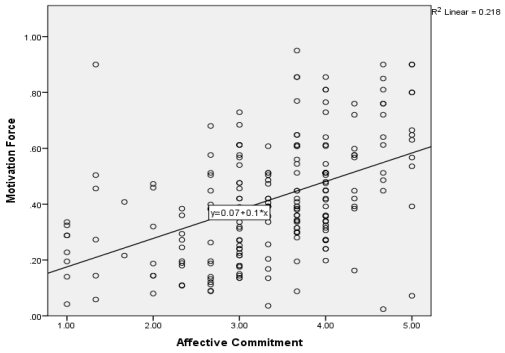


Figure 5.24 Linearity test for Affective Commitment

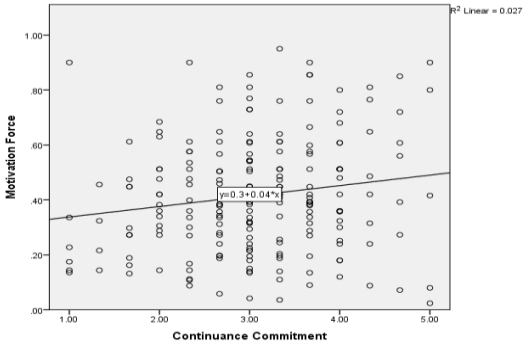


Figure 5.25 Linearity test for Continuance Commitment

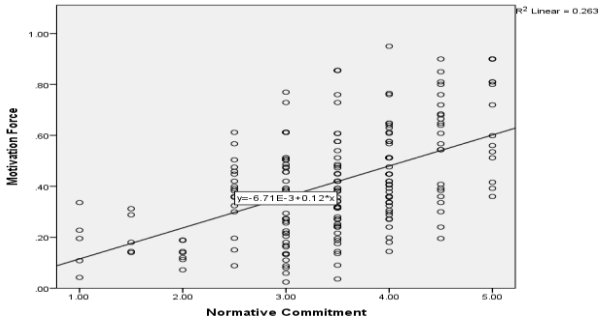


Figure 5.26 Linearity test for Normative Commitment

Table 5.23 Spearman Correlation test for Commitment

		Motivational Force
Affective Commitment	Correlation Coefficient	.495**
	Sig. (2-tailed)	.000
	N	208
Continuance Commitment	Correlation Coefficient	.151*
	Sig. (2-tailed)	.029
	N	208
Normative Commitment	Correlation Coefficient	.492**
	Sig. (2-tailed)	.000
	N	208

As shown in Table 5.23, all the three types of commitment showed a positive association with the Motivational Force level. The two most highly correlated factors are Affective commitment (r= 0.495) and Normative commitment (r=0.492). Therefore, hypothesis H.C.4 was statistically accepted.

5.8.6 **Summary of Stage 5**

This stage followed a deductive approach to testing the level of three Organisational Commitment components (Affective, Normative and Continuance Commitment) in software engineering settings. The results from the inferential analysis are presented in Table 5.24, and also explained by the following conclusions:

- Affective Commitment was affected statistically by neither contract type nor citizenship situation, but it was statistically affected by age group.
- Continuance Commitment was not affected statistically by contract type, but it was affected statistically by both age group and citizenship situation.
- Normative commitment was not affected statistically by the age group, but it could be affected statistically by contract type and citizenship situation.
- All the organisational components were positively correlated with the level of the Motivational Force measured in software engineering environments.

Table 5.24 Organisational Commitment results

	contract types	age groups	citizenship	Motivational Force
Affective Commitment	--	++	--	++
Continuance Commitment	--	++	++	+
Normative commitment	++	--	++	++

5.9 **Chapter Summary**

This chapter contributed to the study aim and objectives (as stated in Chapter 3) in terms of identification of the most representative factors that influence motivation in software engineering environments. Based on the main results, so far, the main construct of the model of motivation is now ready to be built, although there is one factor, which is organisational structure that still needs to be investigated qualitatively in the next chapter. The factors identified and their relationships have captured a wide picture of motivation in software engineering, as motivation was examined in the light of six different motivational theories in software engineering environments.

This chapter followed five stages to reach the aims and objectives of this research. These stages were dedicated to testing five motivational theories (McClelland's Theory, Equity Theory, Goal Setting Theory, Self-Determination Theory and Organisational Commitment Theory) and comparing their applicability in software engineering

environments to influencing the Motivational Force, based on the Expectancy Theory concept. The results of these statistically proven stages are presented in Table 5.25.

Table 5.25 the five stages' results summary

Stage	Independent variable(s)	Theory Adopted	The main findings
1	Member role	McClelland's Theory of Achievement	The Member Role factor is significant for the Need for Achievement in SE.
2	Member role	Equity Theory	The Member Role factor is significant for the Financial Equity feeling in SE.
3	Daily work	Goal Setting Theory	The Daily work factor (projects and operations) has no effect on Goal Setting Theory in SE.
4	Contract types	Self-Determination Theory	The contract type factor is significant for the Extrinsic Motivation factor (Integrated Regulation) in SE.
5	• Contract types • Age group • Citizenship	Organisational Commitment	The contract type factor is significant for Normative Commitment. Age group factor is significant for Affective and Continuance Commitment levels. Citizenship factor is significant for Continuance and Normative commitment.

The next chapter will be dedicated to the qualitative investigation that was conducted to find out the influence of the organisational structure on the motivation level of individuals working in software engineering firms.

Chapter 6. QUALITATIVE RESULTS AND ANALYSIS

6.1 Chapter overview

The results of the preliminary study led to the design of two types of research (quantitative and qualitative methods), as the epistemology of this research suggested, following the pragmatic approach by mixing these two methods.

The previous chapter (Chapter 5) was dedicated to reporting the quantitative part of this research, in which five stages were followed in order to achieve this research's aims and objects. The findings of chapter 5 were driven by adopting a deductive approach by testing six motivational theories (Expectancy Theory, McClelland's Theory of Achievement, Equity Theory, Goal Setting theory, Self-Determination theory and Organisational Commitment theory) in software engineering environments. The results revealed several significant differences amongst this study's sample, based on different independent variables (contract type, team member role in the projects, daily work).

This chapter is **Phase 4** of this research, as listed in the table of the research phases in (Chapter 3; Table 3.2 Research design pages 3-68). The aim of this chapter is to investigate the influence of the organisational structure on the motivation level in software engineering firms indirectly through other factors, which are power conflict, project delay and turnover intention. This could be achieved through a Content Relational analysis approach to finding out how the organisational structure's defects could influence the withdrawal intention between several organisations.

By the end of this chapter, all the factors will be tested and examined in this study of software engineering environments. Hence, the next chapter will discuss the results and build the aimed motivational model.

6.2 Problem Overview

Software applications are developed differently based on each organisation's needs and requirements. Software engineering projects are fundamentally based on three considerations (time, cost and quality), each of which is affected by organisational

factors. Both the Project Management and Software Engineering fields have emphasised the role of organisational structure in the quality of the deliverable software applications, recognising that organisational structure influences flexibility, reporting relationships and conflict management during the software development lifecycle. The organisational structure has an impact on the choice, design and development of information systems (Al-halak et al., 2010; Baxter & Sommerville, 2011; Beynon-Davies, 2002). The relationship between organisational structure and innovation performance in a large sample of UK small and medium-sized enterprises was observed by Cosh et al. (2012), who showed that decentralised decision-making, supported by a formal structure and written plans, supports the ability to innovate (Cosh et al., 2012). Most organisations achieve limited success and undertake many restructurings, involving considerable social cost and limited gains in effectiveness (McMillan, 2001). The interaction between Information Systems (IS) and organisational structure is seen mutually from each side. The structure of a particular organisation could change IS design, and conversely, IS outcomes could change the structure and the workflow of the organisation. Empirically, organisational structure models need to consider two important issues, (1) Determining the project level to achieve a satisfactory level of group dynamics (2) The fit between the parent organisation and the new selected structure (Moore, 2002). From the perspective of project management in public sector organisations, there are three main models: Functional organisation, Pure Project structure (with dedicated project teams) and Matrix organisation (Larson and Gray, 2011).

In a **Functional Organisational** structure, the organisation attempts to link each project directly to the associated functional department in the organisation, as shown in Figure 6.1.

In **Pure Project Organisation** (also known as dedicated teams structure), the organisation tries to create a new, exemplary, independent working environment that is supplied with efficient staff members and project managers in order to implement its projects with a high level of efficiency and professionalism (Larson & Gray, 2011), this structure is illustrated in Figure 6.2.

In **Matrix Structure,** the organisation tries to combine project organisation with the parent organisation in order to enable a project manager to control what is to be

done by the individuals and groups assigned to each project while they are doing their daily tasks at their workplaces (Larson & Gray, 2011; D. R. Moore, 2002). This structure is illustrated in Figure 6.3.

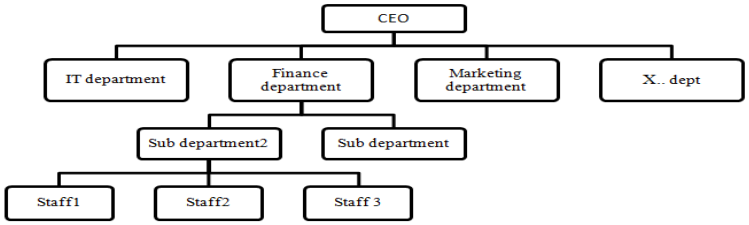


Figure 6.1 Functional organisational structure (Larson & Gray, 2011)

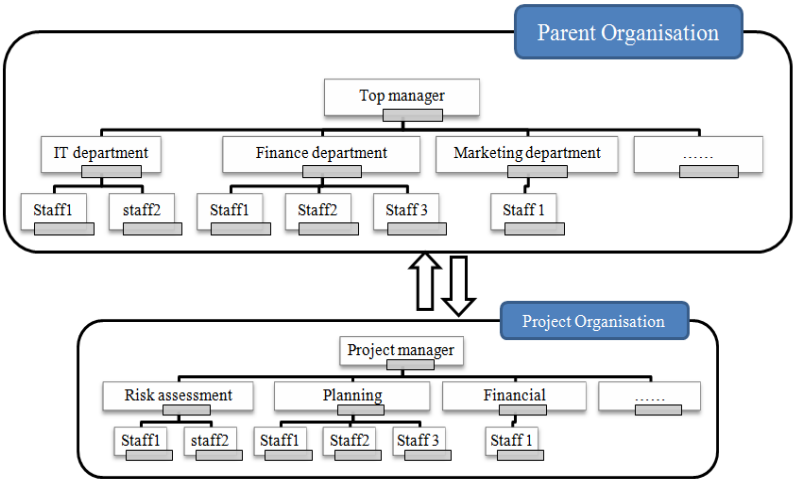


Figure 6.2 Pure project organisational structure (Larson & Gray, 2011)

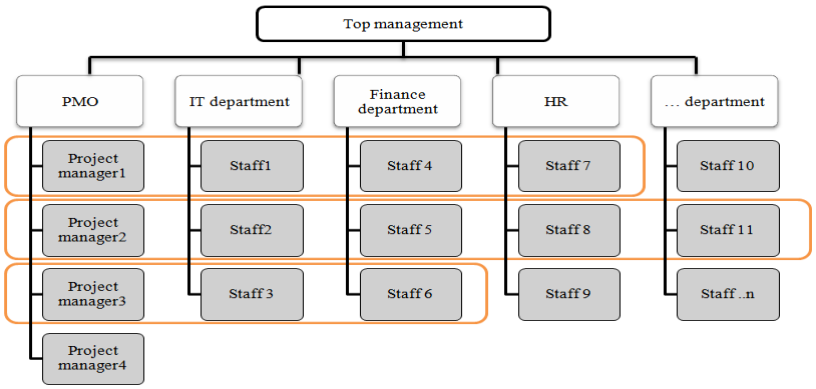


Figure 6.3 Matrix organisational structure (Larson & Gray, 2011)

Based on the gap in the literature review, as identified in Chapter 2, and the findings from the preliminary study of this research, as identified in Chapter 4, this chapter pursues bridging these gaps and reports on a qualitative study which highlights the

impact of the organisational factors on the software development processes. A new proposed organisational model is to be developed, as an additional contribution of this study, which in turn, could increase the success rate of software engineering projects, and could be positively reflected in the individuals' commitment to work in these organisations.

6.3 Study Questions

According to this research's questions (as shown in section 3.3 Research Questions page 3-61), the third question is concerned with the organisational factors that could influence motivation level in software engineering environments, as follows :

Q3.**What is the influence of the organisational factors on software engineering's motivation level?**

Hence, the preliminary study in this research (Chapter 4) uncovered two types of factors that needed to be investigated in order to answer this question (Q3). The first types of factors were investigated quantitatively in Chapter 5 by testing the organisational commitment in software engineering. The second consisted of factors needed to be investigated qualitatively in this chapter, which is related to the organisation structure and hierarchal processes, as mentioned in the research emergent questions (see page 4-84) as following:

Q12.**What is the influence of organisational structure on software development processes?**

Q13.**What is the influence of organisational structure on turnover intention in software engineering environments?**

Based on the concepts mapping that was presented in the results of the preliminary study (see 4.3.4.5 Concepts Mapping page 4-79), the investigation of the role of the organisational structure in software engineering will be presented in this study using the model as shown in Figure 6.4.

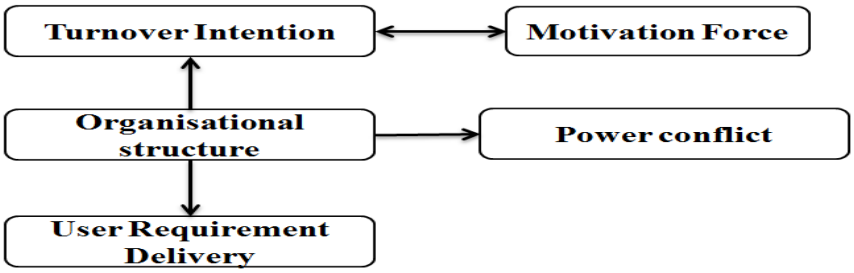


Figure 6.4 Organisational structure conceptual model

In light of the proposed model as shown in Figure 6.4, this study tries to continue answering the research questions Q12 and Q13 as mentioned above.

Each part from the proposed conceptual model tries to uncover the influence of the organisational issues from different aspects. For example, issues related to the main organisational structure and workflow can be explained by decision makes or high authorities in the organisation, while issues related to the conflict in the workplace can be seen clearly from another layer of employees in the organisation such as IT project managers and operational staff. In addition, issues related to the project delivery or requirements handover can be answered by software end users. Therefore, the interview questions where designed in three layers to be answered by three different types of people as shown in Figure 6.5. Hence, answering these questions could provide valid answers for the research questions Q12 and Q13. Copies of the interview forms are shown in the Appendix (E).

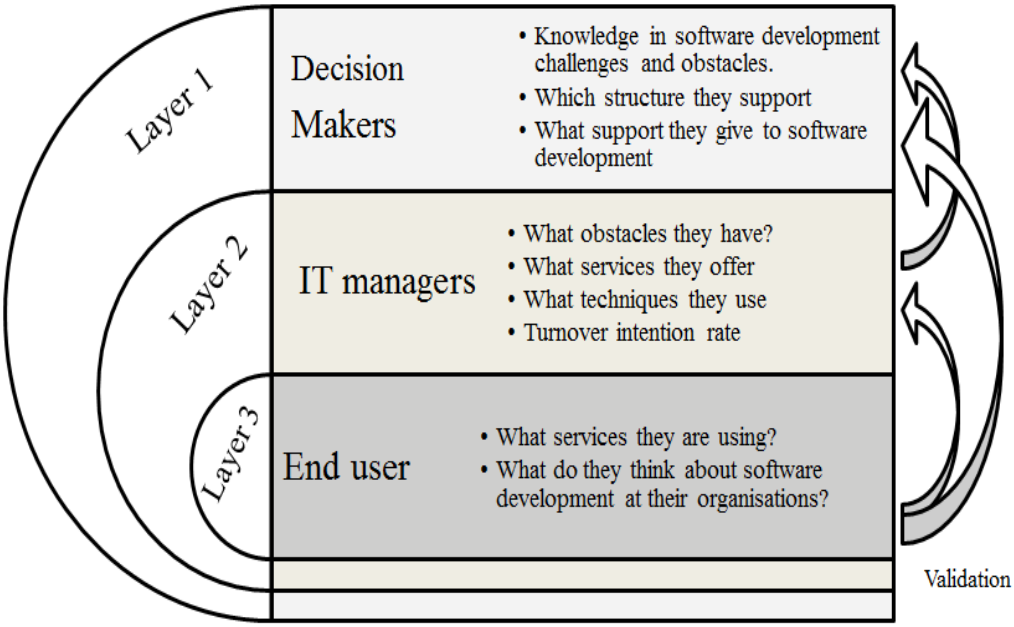


Figure 6.5 Interviews 3 layers questions

6.4 **Qualitative Research**

In this stage, two questions are required to be answered regarding software development processes and (including the delivery of requirements to IT departments and IT departments' reporting back on progress) and turnover intention within each organisation.

The qualitative method is defined as: "a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns" (Hsieh & Shannon, 2005), it is also defined as "an approach of empirical, methodological controlled analysis of texts within their context of communication, following content analytic rules and step by step models, without rash quantification" (Mayring, 2000). These two definitions illustrate that qualitative content analysis emphasises an integrated view of speech\texts and their particular contexts. The qualitative content analysis moves beyond counting words or extracting objective content from texts, to examine meanings, themes and patterns that may be manifest or latent in a particular text. It allows researchers to understand social reality in a subjective but scientific manner.

6.5 **Interview Design**

Fontana and Frey (1994) believed that fellow human beings commonly and prominently use interviewing as a way to understand each other. Therefore, a series of qualitative interviews were considered as a most appropriate approach to obtain the required knowledge at this stage of the study. Scholars have categorised the approaches of the interviews in different ways:

1. Structured and unstructured (Fontana & Frey, 1994; Marvasti, 2003; Yin, 2010).
2. Standardised, semi-standardised and unstandardized (Berg, Lune, & Lune, 2004).
3. Informal, structured, semi-structured and unstructured (Bernard & Bernard, 2012).

Several levels of formality are used in interviewing. Informal interviewing could occur unexpectedly with no prior preparation, and the interviewee has no control over its course. However, most of the sessions were held by adopting a formal preparation and conversational approach.

In structured interviews, the interviewer follows a strict structure where all participants are asked the same questions in exactly the same questioning context (Bryman & Bell, 2011), while in semi-structured interviews, the questions and their order are predetermined in an interview outline, but the researcher has some flexibility to change and alter the questions to probe further significant replies.

For the purpose of this research, a semi-structured interview type was chosen to be the most appropriate technique for the following reasons:

1. The researcher has to direct the interviewees towards the required data, and then encourage them to give some elaboration and extension of their answers, based on their views and perspectives.
2. The researcher has to manage the direction of the interviews towards software development rather than other organisational issues (Wood, 1997).
3. Controlling the interview time. Each interview session was divided into three parts (the current situation in software development, the best organisational structure to suit the participants' organisation, and then an evaluation of some existing and proposed project management practices and turnover intentions).

6.6 **Sample Design**

Wilkinson (2002) found that interviews could be used when in-depth information is required, the subject matter is potentially sensitive and the issues under examination would benefit from development or clarification (Wilkinson, 2002). Therefore, in-depth interviews were selected to answer this study's questions, with the sample taken from three layers of software project stakeholders: Decision makers, IT project managers and end users.

For the purpose of availability and applicability, Saudi Arabian public organisations were selected to be the representative sample in this study, as the Saudi Government leads most of the central software projects through its ministries. Therefore, five governmental organisations from the Saudi Arabian public sector were chosen to be this study's sample. All the selected organisations provide domestic public services to Saudi citizens through a diversity of software projects around Saudi Arabia. Participants were chosen by using probable stratified sampling, as they were selected from different strata (Patton, 2005).

Piloting the questions was essential and important to validate this study's questions and therefore three participants were interviewed separately and consequently, some modifications were made to the original script. After the pilot sessions, 30 potential interviewees from 5 different public organisations (including all the three sample layers) were contacted and asked for a 30-minute meeting session. 25 of them accepted the invitation. The sample distribution is shown in Table 6.1**.** Interviews took place in Saudi Arabia and sessions were recorded on tape and then transcribed into Arabic before being translated and transcribed into English for analysis.

Table 6.1Sample distribution over organisations

Organisation name	Org no.	**Decision maker**	**IT manager**	**End user**	*Total*
Ministry of education	Org. 1	1	2	2	*5*
Ministry of Health	Org. 2	2	1	2	*5*
Saudi Post	Org. 3	2	1	2	*5*
Ministry of Labour	Org. 4	1	1	2	*4*
Ministry of Civil Services	Org. 5	2	2	2	*6*
Total		*8*	*7*	*10*	*25*

6.7 **Interview Analysis Approach**

The aim of this study is to provide a real insight into the explicit impact of the organisational structures, adopted by Saudi government organisations, on the software development process, and whether this effect occurs because of these structures or by coincidence, and how this effect impacts individuals' motivation to remain at these organisations.

For the purpose of this study, a Content Relational Analysis technique was used in analysing the data from these interviews. This method involves two stages: first identifying concepts and then exploring the relationships between these concepts (Navenec & Hirst, 2010). Erlandson (1993) argues that analysing interview data needs to be done through four elements:

1. Unitising data.
2. Emergent category designation.
3. Negative case analysis.
4. Bridging, extending and surfacing data (Erlandson, 1993).

Regarding the strategy used in interview analysis, Paterson (2010) stated that a within-case analysis is used with in-depth interviews to carry out an in-depth exploration of every single organisation as a stand-alone entity (Paterson, 2010). Furthermore, in the present study, the cross-case analysis was conducted to identify the consistencies across these organisations and the reasons for any convergence or divergences identified (Handfield & Melnyk, 1998).

Moreover, a within-case analysis has helped in identifying the organisational structure adopted by each organisation. This was achieved by investigating participants' contributions from every organisation across the three sample layers. Accordingly, a qualitative evaluation through in-depth interviews was conducted to have a clear insight into how requirements' delivery and power influence are being practised in each organisation.

Content Relational analysis was used in this study in order to pinpoint the most recurrent emergent patterns or "concepts" for each organisation and then all the recorded phenomena and themes were linked with the structure adopted in that organisation. Bias avoidance was assured by considering the most emergent themes

at every organisation as the main characteristic of this organisation's structure. Project management skills were assessed by conducting a negative case analysis in order to identify the contradiction between the ideal and existing practices.

In summary, three different types of people were interviewed in-depth. A within-case analysis was conducted in these interviews in order to link the contributions of each sample to those of their counterparts from different layers and analyse them precisely.

6.8 **Validity**

Validity is concerned with how well the test actually measures what it sets out to measure (Ereaut, 2002). In a quantitative approach, the validity is limited to measurements and requires results in numbers, but in qualitative approaches there are no numbers to be tested in terms of the validity. However, (Lewis & Ritchie, 2003) argued that validity is equally important in qualitative research. According to Easterby-Smith et al. (2008), a valid research study should answer the question *"Does the study clearly gain access to the experiences of those in the research setting?"*

Any qualitative researcher should be concerned about validity and reliability while designing a study and analysing its results (Patton, 2005). Participants' answers were validated in three ways:

1. The arrangement of the interview. This process involves the following steps:
    a. The 25 interviews were conducted with experts who are all currently involved in the research subject (software engineering projects).
    b. All interviewees are from different departments located in different organisations.
    c. The organisations are different in terms of the type of the primary business and services.
    d. Making sure that the findings do not contradict the general knowledge of the investigated topic. This could be recognised when answers are found to be generally recurring.
2. The question design. This process involves asking the same questions throughout the three layers, as shown in Figure 6.5, and end users' opinions were matched with answers from participants in other layers' and linked to the structure being used in that organisation.

3. The documentation method was also used as a validation tool. This documentation was gathered to identify the current organisational structure and to compare it with participants' contributions in the interviews, in order to highlight any contradictions or consensus in the information.

6.9 **Reliability**

Johnson and Duberley (2000) stated that reliability is concerned with the consistency of findings acquired in research (Johnson & Duberley, 2000). Flick (2009) elaborated this, saying that "*Reliability gains its importance as a criterion for assessing qualitative research only against the background of a specific theory of the issue under study and about the use of methods*" (Flick, 2009). This statement evaluates the reliability of findings against two conditions, the background of the related parties to the investigated subject and methods used in reaching such findings. In terms of background, two criteria have been considered for reliable candidates: (1) experience in software engineering projects and (2) taking a central part in any under-development software project. In terms of the reliability of methods used, the means of digital recording and concurrent note writing was chosen to increase the reliability of data acquisition, interpretation, and comparability. This approach was adopted so that any noted remarks during interviews could be later used to assist in clarifying the actual recorded data.

Also, within the context of increasing reliability, the method of semi-structured interviews was adopted so that participants in all the interviews were asked questions revolving around the same subjects. Moreover, different models of organisational structures, developed based on the literature and/or modified by the researcher, were shown to each interviewee for further assessment and additions. This was done so that the developed structure would achieve the consensus of all participating organisations.

6.10 **Interview Results**

6.10.1 **Audio-Taping Transcription**

The interviews were conducted in the Arabic language and recorded by voice recorder, except for some interviewees who refused to be recorded, as mentioned in the limitations section of the study.

Note-taking was used while interviewing some leaders instead of voice recording because of politeness. Voice recording is sometimes not acceptable culturally.

Furthermore, they might think of it as a press interview, which would affect the quality of the given information.

All interview recordings were heard and tracked carefully. Hence, the noticeable and important concepts were recorded and transcribed. The copy of the interview transcript is shown in Appendix (F).

6.10.2 **Variables and Concepts**

This study's questions were prepared and 25 interviews were undertaken during a period of 4 weeks. All interviewees were involved in software development projects. The results of these interviews were drawn up based on the interviewees' types (Decision makers, IT projects managers and end users).

A summary of the interview results is shown in Table 6.2. This table also presents the structures found in each organisation and the themes that were identified from each type of interviewee. These concepts were extracted from the interviews transcriptions by using a content relational analysis approach.

Table 6.2 Interview Themes and results (grouped)

Organisation	Structure	Decision makers layer 1	IT managers layer 2	End users layer 3
Org1	Functional	Supportive E-gov competitor Active management	Sole control Resistance Awareness Managerial obstacles Projects are delivered Bureaucratic and formal communication channels Technical Confidence High turnover rate	Conflict with IT Mistrust with IT Requirements ambiguity Mistrust project completion Intellectual property
	Pure Project	Indirect support Contractual skills E-services competitor	Deadline handover Team working Autonomy and flexibility Low turnover intention	Low awareness Low participation
Org2	Functional	Supportive Active management	Sole control Resistance Awareness Managerial obstacles Informal communication needed Moderate turnover rate	Requirements ambiguity Formal communication Formal coordination Intellectual property

Org3	Functional	Supportive E-gov competitor Active management	Power and control Managerial obstacles High PM skills Delay reasoning High turnover rate	Formal communication Formal coordination power conflict
Org4	Matrix (strong)	Supportive PM knowledge E-gov competitor Interactive with IT Through PMO	Reporting process High PM skills Task awareness Resistance Awareness Low turnover intention, not important	High participation Weekly meeting Direct communication Conflict with their functional managers
Org5	Matrix (balanced)	PM knowledge Indirect support E-gov competitor	High PM skills Project awareness Technical Confidence Low turnover intention, and not important.	Moderate awareness High participation Conflict with their functional managers

6.10.3 **Decision Makers and Software Development Strategies and Support**

The research's participants in this layer were invited from five different organisations (referred to as Org1 to Org5). Each participant was asked three questions. The first question was designed to measure their understanding of the challenges facing software development projects and the ways they cope with them. The second question was about the organisational structure that was being adopted in their organisation, and the last question was about their support for and interactions with software development projects. Regarding the first question, participants were confident and optimistic about their future plans for software development projects because of the expected benefits of utilising the power of technology in their organisations. However, only two of them (40%) showed a high level of understanding of the obstacles that they might face in software development, whereas other participants (60%) showed a relatively average level of knowledge about the challenges of software development. Moreover, (80%) four interviewees explained their enthusiasm by the high degree of competition between all the government agencies in achieving the strategic targets of E-government programmes by the end of 2015 (Yesser, 2013). The second question tried to determine which organisational structure from the three models was adopted in each organisation and whether they were trying to change their structure or not. Org1 was developing two IT projects concurrently and each project was being implemented in a different project structure. The first project was within a Functional Structure, as the IT department was

the exclusive leader for this project, whilst the second project was being implemented in a Pure Project structure, as the project was located in an external environment with a dedicated team and structure. Orgs 2 and 3 were purely Functional in structure, as the IT department was leading all software development projects independently. Org 4 used a strong Matrix organisational structure managed by the IT department, as they had been using a functional structure before their conversion to the new model. Their IT projects were monitored and directed by an internal Project Management Office under the supervision of the IT departmental manager. Likewise, software projects in Org5 were conducted within a balanced Matrix structure through an internal PMO managed jointly by the IT department and relevant functional departments.

The last question asked about support for software projects at their organisations. A strong theme emerged from those who were adopting the functional structure. This theme consisted of the support, monitoring and direct management of software projects, as the organisations rely on IT departments to accomplish these projects. Participants from Pure Project structures were grouped under an *indirect support* theme, as they required an intermediary to inform them about software development progress and they gave their support back through the same intermediary. Lastly, participants from Matrix structures showed direct interaction with the software projects' progress as the PMO frequently reported to them. However, project management skills were not mentioned explicitly by the Functional structure adopters.

6.10.4 **IT Project Managers and the Current Software Development Process**

From the analysis of interview themes, IT managers from Functional structures showed a high level of "power and control" over all their projects and over all other corresponding departments. Some themes emerged, such as "Technical Confidence", "Resistance awareness", "we are facing managerial difficulties", "formal communication" and "bureaucratic processes", with a high level of turnover intentions among their staff. Different themes emerged from the IT managers in Pure Project structures, where most of the observed expressions were "Deadline dates", "Team working and development" and "work flexibility". They did not present any negative issues related to financial difficulties or managerial obstacles. Moreover, the turnover intention was rated at a low level in this type of project structure. Project managers in Matrix structures (both balanced and strong) showed a high level of knowledge about project management practices, although a moderate theme emerged from "conflict" in

many places in the interview. However, the turnover intention was rated at a very low level since they were dealing with different resources replacement techniques, as tasks were being performed by an assigned member of the relevant departments.

6.10.5 End Users' Confidence Level in the Software Development Process

End users were interviewed primarily in order to validate the interview results from Decision makers and IT project managers. Interviewing different types of people from the same organisation was an indispensable part of this study, in order to augment the validity of the participants' contributions throughout each adopted structure.

In Functional structures, end users showed positive feelings towards the importance of technology and software projects. However, a few negative themes emerged in these interviews which were "power", "authority", "control", "inequality in promotions", "delay in projects", "unseen results" and "bureaucratic processes". These themes from end users in Functional structures partly contradict some of the Layer B (IT managers') contributions, indicating a power conflict.

In a Pure Project structure, the end users did not show any positive awareness about software development progress although they showed a moderate confidence level that IT projects would be delivered to them on time. The most common theme that emerged was "External team". Interestingly, end users from Matrix structure organisations showed positive awareness of the project's progress and were aware of the hand-over dates which were reported by email from the PMO about the project's increment. Each corresponding department also has at least one designated person in a software project to represent his department at that project, usually a domain expert from that department. A moderate theme emerged from implicit competition among functional employees to become part of the PMO team to get more power and information.

6.11 Discussion of the Interviews Result

The results from three layers of interviewees revealed several important points that should be discussed separately as shown in the following subsections.

6.11.1 Software Development in Organisational Context

From the results shown in Table 6.2, it became apparent that the Functional Organisations were adopting a traditional command and control hierarchy administered in a formal and organised manner. Effort and ideas recognition was one of end users'

concerns during the requirement gathering stage, as IT members took the dominant roles and motivation. Nevertheless, a lack of project management skills of IT managers might have exaggerated this gap and conflict between end users and IT team members. Moreover, neither IT managers nor end users were highly confident that software projects would be accomplished within satisfactory bounds of time, cost and quality, due to the long formal processes. In this structure, projects' flexibility and agility were impeded. This supports previous views of (Ford & Randolph, 1992; Rainey, Backoff, & Levine, 1976) that lack of management of projects' stakeholders and requirements in functional structure increased the risk of power conflict and poor requirements' delivery. The functional organisation is primarily created to manage different types of business which are not focused on software development. Therefore it indicates weak points specific to software development.

Secondly, in a Pure Project structure small independent organisations showed signs of high professionalism in their practices, and the parent organisation did not need to exert any influence over a project's implementation, as long as the dedicated team were reporting as projected. As pointed out by (Larson & Gray, 2011), this organisation is meant to be created temporarily for projects that could be transferred back to the parent organisation, or for projects that have been conducted to help organisations through transition periods. Therefore, this structure might not be applicable for organisations with constant and permanent development requirements.

Lastly, the Matrix structures (strong and balanced) showed interactive and directive approaches in implementing software projects in Orgs 4 and 5. Although IT project managers took the dominant role in this structure and this caused some power conflict within these two organisations, project progression and reporting systems were satisfactory from the perspective of end users. This structure was recognised and adopted in these two different organisations, but it was influenced by the main framework of the organisation and so it had not always been implemented fully in either organisation. If power distribution is not carefully managed, then the matrix structure may be converted to a new functional department. The results show that conflicts still exist which might impede the delivery of project management practices.

6.11.2 **The Organisational Structure and User Requirement Delivery**

The process of clarifying users' requirements differs from one organisational structure to another. In a Functional structure, clarification of users' requirements takes a 6-step approach from the end user to the developer, as shown in Figure 6.6, which is twice as long as in the Matrix structure, shown in Figure 6.7. The results confirmed that end users in Functional organisations felt that the long communication chains and the formal processes required by IT managers often resulted in requirements documents that were ambiguous and difficult to correct or clarify.

Although a Pure Project structure was adopted only after the acceptance of clear and complete requirements, interviewees revealed that it was likely that they looked for fast and direct communication channels when any later changes in the requirements occurred. However, delivering requirements changes took longer than expected as shown in Figure 6.8**.**

In the Matrix structure, fast, clear and direct requirements delivery was constructed with a flexibility level higher than for the Functional and Pure Project structures, as all project members were linked to the project manager directly.

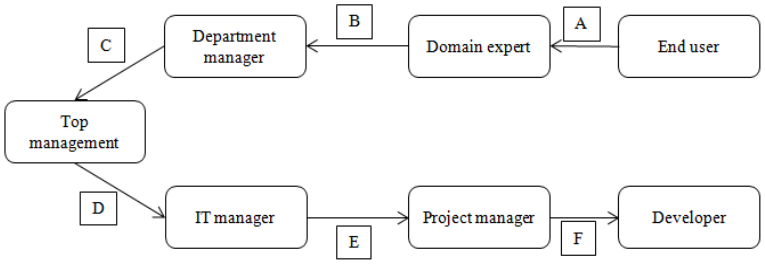


Figure 6.6 Requirement journey in Functional structure

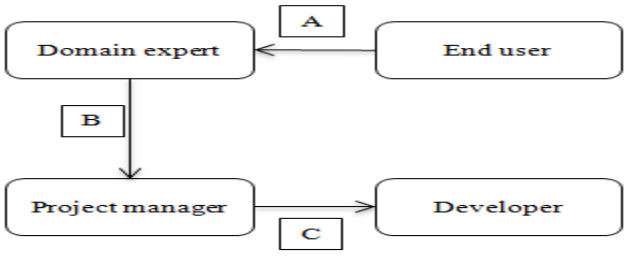


Figure 6.7 Requirement journey in Matrix

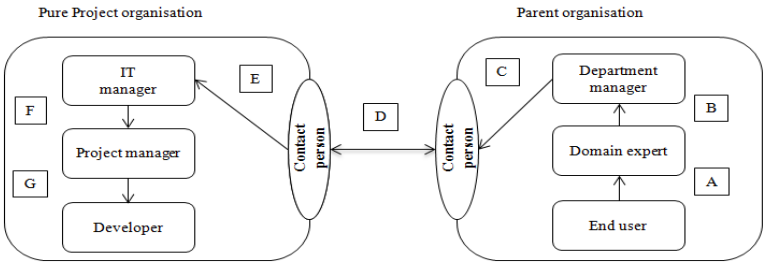


Figure 6.8 Requirement journey in Pure Project

6.11.3 **The Organisational Structure and Reporting Relationships**

According to Nasir et al. (2008), users participation and interaction in software development stages has become an indispensable part of the development lifecycle, and their active roles in reporting relationships could be one of the project's success factors (Nasir, Kamal, & Rozali, 2008). Reporting relationships vary from those in Functional structure (slow and formal) to Pure Project and Matrix (fast and direct). From the interviews, it was found that reporting in a Functional structure followed the same path as a user requirements flow, whereas in Pure Project, reporting this took place as node-node reporting. This happens between two counterpart agents (Reporting Agents RA) in the parent organisation, as was also the case in Pure Project Organisation, as shown in Figure 6.9. End users looked for fast and immediate reporting processes as they were concerned about software bugs and the interface defects. In addition, they found that explaining such issues technically were out with their roles in the organisation. Conversely, IT managers tried to receive immediate reports, as they were moving towards a project's closure stage and going back could've made changes more sophisticated.

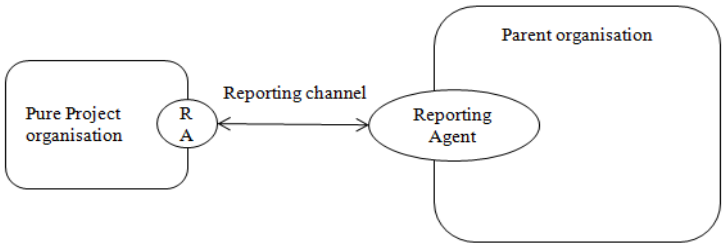


Figure 6.9 Pure Project reporting relationships

The participants reported that, in a Matrix structure, reporting relationships took a direct and instant message delivery by communicating directly with the project manager, who could then either respond or forward these reports to the intended destination, as shown in Figure 6.10.

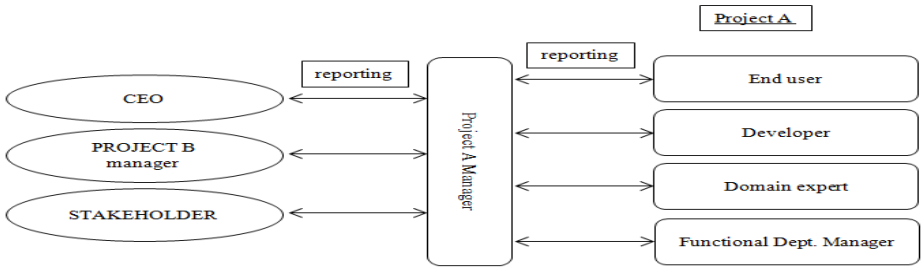


Figure 6.10 Matrix reporting relationships

6.11.4 **The Organisational Structure and Turnover Intention Rate**

From the perspective of the IT project managers in this study, there were noticeable differences between the three organisational models. In a functional structure, software engineering staff tended to avoid problematic issues, as it could cause lots of stress at work. Power conflict and the delay in meeting the users' requirements increased their negative anticipation of project failure. In the software engineering industry, individuals who participated in successful projects were always attracted to higher positions with continued career development. Therefore, the fear of project failure could develop the turnover intention in the Functional organisational structure. In Pure Projects and Matrix structures, the turnover intention was not considered a problematic factor that could hinder the project's progress. This could be attributed to the mediating role that project managers played in these types of projects. The technical staff worked either autonomously in a Pure Projects structure or are managed professionally in a Matrix structure.

6.11.5 **Limitations in Organisational Structure**

From the results presented, it appears that public organisations are limited to adopting one of the mentioned structures (Functional, Pure Project and Matrix). Although Functional structure is the most commonly adopted paradigm in public organisations, the decision makers in this study showed awareness of and a positive attitude towards the necessity to modify their organisational structures to accelerate the software development process.

A Pure Project structure is considered a temporary and costly structure, but it could produce qualified on-demand software if requirements and plans are stable (Larson & Gray, 2011). Lastly, a Matrix structure was reported by the participants as more dynamic and interactive, but they also said that this model needed more professionalism

in project management practices if it was to be adopted efficiently. A lack of experience in government authorities led to weaknesses in the Matrix structures.

In summary, the Functional structure created conflict and slowed down the software development processes with high levels of turnover intention. The Pure Project was reported as costly and ran the risk of violating the organisation's policies by creating a new small organisation. Lastly, the Matrix required more professionalism and tools than was currently available, to manage software projects seamlessly.

6.12 **Independent Project Management Office (IPMO) Structure**

Since all public organisations are explicitly restricted to changing their structures, they could accept tenders from companies in the project management consultation sector and so they could utilise these contracts to create an Independent Project Management Office (IPMO) to manage all the organisations' projects efficiently and directly, including all software projects. Therefore, a new model called the Independent Project Management Office (IPMO) was developed, as shown in Figure 6.11**.**

The aim of this model is to apply project management practices within a robust organisational structure. It combines both Functional and Matrix structure in one paradigm, to be managed by a third party, who will protect power distribution, as well as the parent organisation's cohesive structure.

The developed model (IPMO structure) protects the authority level of each functional department to avoid power conflict and then provides a high level of project management practices in the organisation.

6.12.1 **IPMO Model Validation**

The proposed model (IPMO), as shown in Figure 6.11, is intended to facilitate the development processes and increase the quality of requirement delivery as well as reduce the potential conflict, which in turn, would benefit diverse aspects of software projects. This structure has been validated by conducting short subsequent interviews with the Decision makers' layer, in order to ask them about the applicability of this model. A model-based diagram was prepared and then discussed with them. 7 out of 8 Decision makers supported this model, whereas the 8th expressed some reluctance because of the potential lack of software development experience in the third party, as they will be dealing with all kinds of projects at the same time. About three decision makers raised a critical

point as IT managers might show a low acceptance level of this model due to issues of control re-allocation.

The IPMO model is an alternative option to be taken into account by decision makers when discussing structural ways to reach better project implementation. Therefore, it could be considered one of the available options for any Real Option analysis in making crucial decisions during project execution. This can minimise the losses and maximise the success rate (Copeland & Antikarov, 2001).

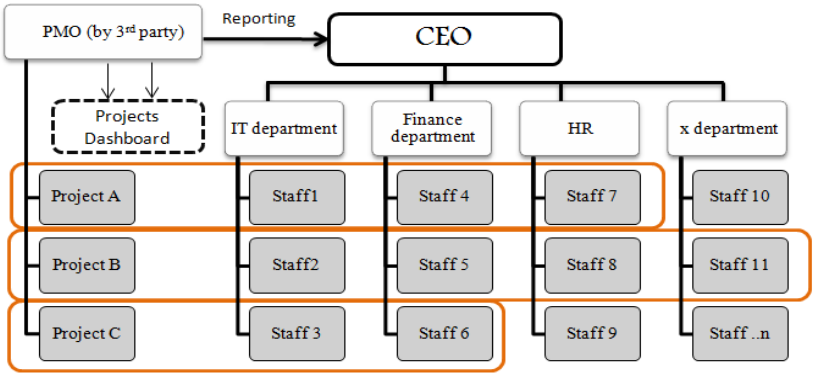


Figure 6.11 IPMO structure

6.13 **Chapter Summary**

The primary aim of this study is to investigate the influence of three organisational structures on software development progression and turnover intention. This study attempted to capture how organisational structure affects software development in the workplace. In particular, it explained how software development projects were embedded in the workplace and shaped by organisational commands and processes. In-depth interviews were conducted at different organisational levels, which highlighted substantial difficulties in existing structures for software development, especially power conflicts, requirements ambiguity, complex reporting relationships and bureaucratic processes. This research's within-case analysis revealed empirical evidence that power conflicts and problems in reporting relationships took place in all of the three major types of organisation (Functional, Pure Project and Matrix). However, turnover intention rate was seen to be at a higher level in Functional structures. More positively, leaders and decision-makers showed positive support for the conversion of public organisational structures to be more flexible and autonomous. A new model (IPMO) was developed and validated in order to augment the flexibility and accountability levels and

thus reduce the power conflict within organisations during software projects' implementation and turnover cases. This model consists of an external consulting company to run a project management office. This will need to elevate the project management authority level to lie between Top management and Functional departments, rather than to be on the same authority line with functional departments, and hence eliminate interference between corresponding parties.

Therefore, from the results of this phase it could be concluded that the motivation level of individuals working in software engineering is influenced indirectly by the fear of project failure and its consequences on their career record. Hence, a conceptual model is suggested to be added to this study's model as shown in Figure 6.12.

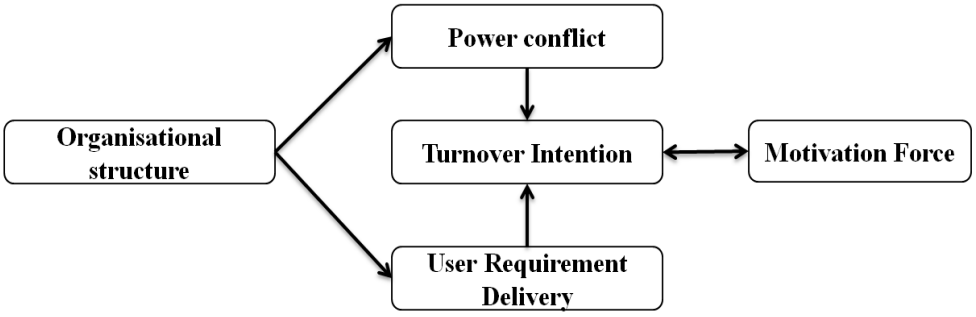


Figure 6.12 Organisational structure conceptual model

Chapter 7. DISCUSSION AND DEVELOPMENT OF THE MODEL

7.1 Chapter Overview:

It was concluded from the literature review (chapter 2) that motivation can be experienced by individuals in software engineering by a combination of factors from three different groups (interpersonal, occupational and organisational). This conclusion was followed by a qualitative research by conducting a preliminary by interviewing 8 experts in software engineering environments from different roles and environments This preliminary study and the conversations have revealed new factors, and expected associations between the new factors, therefore a conceptual model was suggested as shown in (Figure 4.2 Initial model of the research, page 4-81). The suggested model consists of multiple correlated variables sourced from either the motivational theories in the literature or the current practices of software engineering as resulted from the Preliminary Study (see 4.3.4 Interviews Results and Findings page 4-76).

This research is designed based on 6 phases as described in (Chapter 3, 3.4.5 The Research Techniques And Design). Four of these phases were completed by the end of Chapter 6. Hence, this chapter continues by conducting the fifth phase, which is entirely dedicated to a general discussion and then developing the final validated motivational model in this thesis, which is considered the validated version of the suggested model presented in Chapter 1 (see Figure 4.2).

Conceptually, this research's aim is built upon the interaction between three major groups of factors (interpersonal, occupational and organisational factors) as stated in the research questions Q1, Q2 and Q3 page 3-62. These three groups were tested statistically in chapters 4, 5 and 6, and the results were presented, explained and validated.

The previous three chapters (4, 5 and 6) were concerned with reporting on two types of research (deductive and inductive studies) carried out to test different theories and factors. This chapter is now going to combine the results of these three chapters in one complete model, to show the validity of the suggested model and the applicability of

these results in software engineering environments. The findings, limitations and recommendations of this thesis will be reported in the next chapter (The Conclusion).

7.2 **Introduction:**

This chapter discusses the key findings of both the quantitative and qualitative studies that have been carried out regarding the motivation level in software engineering environments. The overall research question in this study is (as stated in page 3-61):

How does the interaction between the three factors (interpersonal, occupational and organisational) affect the motivation level of professionals in software engineering?

This question is addressed and answered by following five stages of quantitative analysis (Chapter 5) and one stage of qualitative analysis (Chapter 6).

In chapter 4, a preliminary study was firstly carried out in order to test the findings from the literature in the real workplaces, and to seek more potential factors that might influence the motivation level in software engineering environments. The results of the literature review and the preliminary study uncovered the complexity in answering these research questions. Hence, five stages were decided to be followed, as explained in Chapter 5 (see Table 5.1 Inferential Analysis stages, page 5-120), and one stage was to be conducted separately, as a qualitative study.

In the light of different theories in the motivation field, the findings from these five stages are discussed here and attached to the suggested research model, identifying how professionals in software engineering achieve high motivation levels, and how theories of motivation try to explain the overlapping between different types of variables from different sources (interpersonal, occupational and organisational variables).

Although, these factors are tested in this research based on different theories, to be attached to one suggested model, conceptually, they are related to three groups as following:

1. Interpersonal factors: this group is reported by investigating the influence of components of McClelland's Theory of Achievement on the motivational force in software engineering environments, as this theory explains how interpersonal needs and desires are important and influential in workplaces. McClelland’s Theory of

Achievement was tested in order to find out how individual motivation is achieved by meeting three types of needs (achievement, control and affiliation), in order to increase individuals' willingness to do a particular job.

2. Occupational Factors. This group was reported by investigating the influence of three occupational factors (daily work type, member role and contract type) in the light of three different motivational theories (Goal Setting, Equity Theory and Self-Determination Theory SDT) in software engineering environments. Each theory explains one occupational aspect in the workplace: Goal-Setting Theory describes the job design, Equity Theory indicates the management practices in workplaces, and Self-Determination Theory gives many items of evidence regarding the work environments and other aspects that might not be seen directly.
3. Organisational Factors. This group was reported based on two methodological approaches, in order to test two different factors. The first approach is a quantitative approach which tries to measure the organisational commitment in software engineering environments, while the second approach is a qualitative approach which investigates the influence of different organisational structures on the turnover intention (withdrawal from work), and how these structures could impede software manufacturing processes in software engineering environments, which in turn would reflect on the projects' success rate.

This research reveals that motivation in software engineering environments is quite difficult and could be achieved through the interaction between three main components (interpersonal, occupational and organisational), as each component cannot independently motivate professionals in software engineering environments without having further support from the other two components. Thus, the conceptual vision of this research can be illustrated as shown in Figure 7.1.

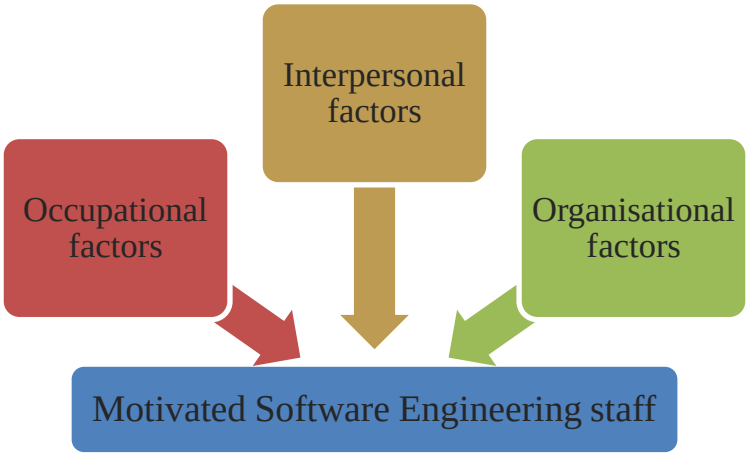


Figure 7.1 Combined way of motivation in software engineering

The following sections, discuss the results from chapters 4, 5 and 6, and then address the following points:

- How does the interaction between the three groups (interpersonal, occupational and organisational groups) occur?
- How could this interaction be explained in practice?
- How could this interaction help in developing this research model?

In order to meet the aim and objectives of this research, the results from Chapters 4, 5 and 6 will be grouped into three types of factors (interpersonal, occupational and organisational). Hence, the motivational model will be constructed gradually, in four stages as follows:

Stage1. The Influence of the Interpersonal Factors on the Motivation Force

In this stage, the findings from testing McClelland Motivation Theory (Achievement, Control and Affiliation needs) are discussed and linked to this study's model, and how member's needs are directed in software engineering environments. Additional results from a published study, conducted by this thesis' author regarding communication in software engineering, are added to this group of factors, as these results could increase the understanding of the Affiliation need and the influence of the team member's role in software engineering environments.

Stage2. The Influence of the Occupational Factors on the Motivation Force

In this stage, the findings from testing three occupation-related factors (daily work nature, member role and contract type) in light of three motivational theories (Goal Setting theory, Self-Determination Theory and Equity Theory) are discussed and gradually linked to this study's model.

Stage3. The Influence of the Organisational Factors on the Motivation Force

In this stage, the findings are driven from two separate studies (quantitative and qualitative). The quantitative part reports on the influence of the contract type on the organisational commitment level and the motivational force, while the qualitative part reports on the impact of organisational structure on turnover intention in software engineering environment. Hence, these results are discussed and linked to this study's model gradually.

Stage4. The Interaction between the Three Groups (Interpersonal, Occupational and Organisational).

In this stage, the interaction between the three groups are discussed and explained, and then the conclusions are drawn and compared to previous studies and literature.

In order to build this research's model based on a statistical basis, four types of arrows are shown in the developed model. Each type of arrow reflects the SPSS results in a graphical way as shown in Table 7.1.

Table 7.1 Explanation of arrows used in the model

Arrow type	Type name	Explanation
	Significant influence	In this type, one categorical variable acts as an independent variable (at the beginning of the arrow), and another continues variable acts as a dependent variable (at the end of the arrow). This type shows that the independent variables groups are different in terms of the level of influence on the dependent variable. This type of influence is measured by means

		comparison tests such as t-test-Anova and Welch.
 Dashed arrow	Non-significant influence	Similar to the significant influence type, but this type shows that the independent variable's groups are equal in terms of the level of influence on the dependent variable.
	Significant correlation	In this type, variables are interacting with each other without consideration of independent or dependent variables. However, this type shows that one continuous variable is correlated with another continuous variable, whether this correlation is positive or negative. This type of influence is measured by bivariate correlation measures such as Pearson and Spearman Coefficient correlations.
 Dashed two ends arrow	Non-significant correlation	Similar to the significant correlation type, but this type shows that neither of these two continuous variables is correlated with each other.

The initial model will be expanded gradually in four stages in order to achieve the final model in this study. Every stage contributes to the final model by adding more factors, therefore the new model will be produced by the end of the last stage.

7.3 Stage 1: Impact of Interpersonal Factors on Motivation in Software Engineering Environments

The influence of interpersonal factors in software engineering environments was explored in literature review chapter (page 2-47). Therefore, the interaction between individuals was suggested as having a significant influence on individuals' willingness to perform at higher levels. However, this interaction was conditioned by meeting three

types of needs in the workplace, as explained by McClelland's Theory. This interaction between software engineering members is discussed empirically in three points.

1. Results from a study conducted by this author (a supplement to this research) regarding the communication tools used in software engineering showed that the team member role and project stage have statistically significant influence on selection of communication tools in software engineering environments. It was found that project members expressed different choices in selecting communication tools in software engineering based on both their roles in their projects and the project stage. For example, developers in the implementation stage do not like to be communicated with through face-to-face meetings (Bindrees, Pooley, Ibrahim, & Taylor, 2014).

Poor communication has been identified as a de-motivator in software engineering in 11 different studies (Rehman et al., 2011). Hence, the link between communication and motivation has been well established in the literature. However, reaching the best communication level in software engineering environments could be challenging.

Members in software engineering work with different disciplines and skills. Some work on technical work, such as development or database management, whereas others do some planning and team management, and others work on coordination tasks such as working on a help desk and customer services. Since they do different types of tasks, it is hypothesised that they have different interests in using communication tools in the workplace. Hence, inappropriate use of communication tools could be disruptive to some of the software project's members, and hence, de-motivate them in the workplace. Therefore, the **FIRST Version** of this study's aimed model was built as shown in Figure 7.2. The contribution in this version is that communication problems are exposed and defined empirically, which, in turn, will help in developing tools to increase motivation levels in software engineering professionals. Considering the findings that the suggested factors member role, the project stage and the development type have an impact on selection of communication tools during the projects' implementation. It is clear that choosing the effective tool is very important and should be agreed officially.

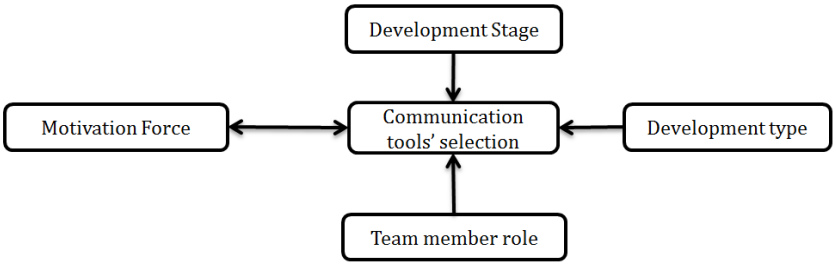


Figure 7.2 Version 1: Communication links

2. Results from Chapter 5 (Stage 1: Testing McClelland's Theory in Software Engineering) show that the team member's role has a statistical influence on the need for Achievement in this study's sample, while other types of needs (need for Control and need for Affiliation) show equal levels of means variances based on the participants in this sample's roles in software engineering environments.

From this result, the member role factor affects two aspects of interpersonal factors' group in software engineering. The first is the communication between project members, and the second is the applicability of McClelland Theory of Achievement in software engineering environments. The Achievement need is statistically different from one role to another in software engineering. This factor was found to be a motivator in software engineering in previous studies (Capretz, 2003; Couger & Zawacki, 1980). Also, Achievement desire could be implied in other factors such as problem-solving (Franca & da Silva, 2009). However, findings reveal that members in software engineering who differ in the level of their Achievement need to work based on their roles. This could change the way that they are motivated, as some of them look forward to achieving challenging goals, and others do not. The coordination staff group showed a lower level of Achievement need factor compared to the other two groups (IT managers and technical work professionals). This could be explained by the repeated nature of their daily work. This repetition appears to be neither a motivator nor a de-motivator for this group of staff. This result provides an insight into how to design coordination jobs in software engineering and make them more challenging. Therefore, different motivation tools and measures are needed to motivate coordination staff in software engineering environments rather than treating them as unimportant jobs in software projects. One major drawback of the managerial practices in software

engineering is that they focus only on the technical staff, with more importance level, but coordination staff are treated as non-technical workers, with a lower importance level in the workplace. This contradicts the concept of team working and collaboration in software engineering, as coordination and other jobs could be the first line of protection for technical staff, as those workers will deal will the all non-technical issues. For example, trying to satisfy customers, monitoring bugs, receiving calls and reports as well as supporting the technical staff emotionally. Another correlated result has been found through testing the Equity Theory, as the results for coordination staff showed another influence, which was on the level of financial equality feeling in software engineering environments. This will be discussed in the occupational factors' group (stage 2).

Based on this findings, the construction of this study's first model (version 1) will be expanded by developing Version 2, as shown in Figure 7.3.

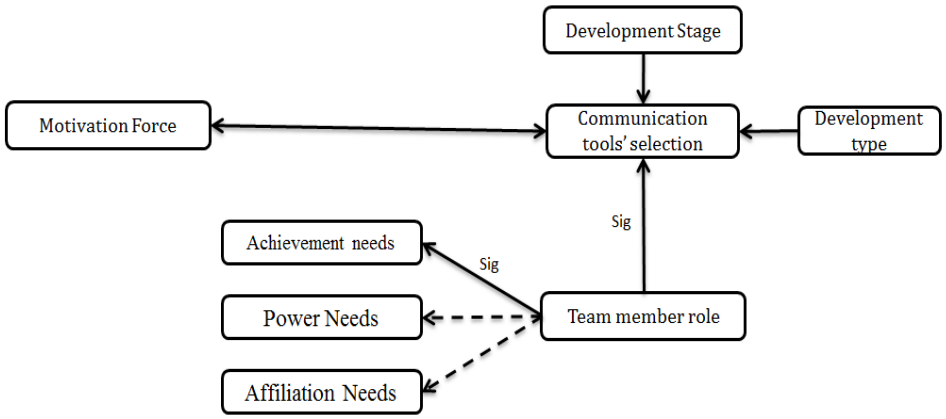


Figure 7.3 Version 2: Influence of member role on needs level

3. Based on McClelland's Theory of Achievement, three types of needs (need for control, need for affiliation and need for achievement) have shown positive correlations with individuals' motivation force level, based on Expectancy Theory (Vroom's theory, 1964).

This result reveals the importance of the fulfilment of an individual's needs in software engineering environments. Although the correlation level is not equal for all the three types of needs, this could direct attention to further investigation into which need was considered as having the highest priority within the sample. Based on the Spearman correlation tests, the need for Power showed a correlation value of (0.581), and the need

for an Affiliation factor showed a correlation value of (0.504), whereas the need for Achievement factor showed a correlation value of (0.261). Accordingly, the order of the needs fulfilment that needs to be considered in motivating members in software engineering environments is shown in Figure 7.4.

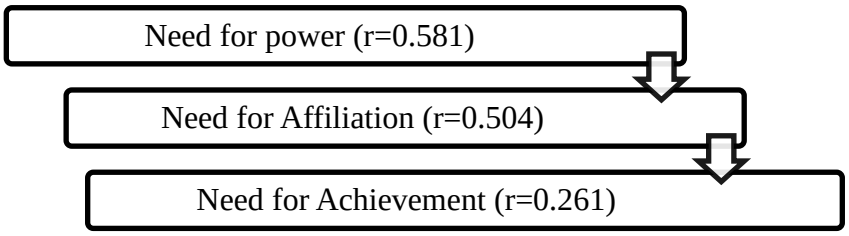


Figure 7.4 Needs order in software engineering

Based on this order in Figure 7.4, the need for power and control is seen to be the most highly correlated need that requires to be initially considered in software projects. The questions asked in this version were trying to mirror the autonomy level in these participants. Hence, highly motivated participants showed a higher level of control and autonomy. The characteristics of software development tasks required a wider range of freedom in choosing the best option for any task. For example, when the database administrator felt that they had a lack of equipment or were restricted in their working environment, this potentially make them work slower than what was expected because of the sense of dissatisfaction at the work.

The correlation of the need for Affiliation is close to the correlation level of Control need. This correlation could provide a good indication of the need for social interaction with teammates in software engineering environments.

It is assumed in this field that professionals in software engineering projects seek emotional and motivational support from managers or teammates, who might also help them in their technical challenges. Although the literature states that a software engineer is introverted by nature with a low need for social interaction and is autonomous (Sharp et al., 2009), this study provided empirical evidence that increasing the satisfaction of the need for collaboration and social activities in software engineering could increase the motivation force level in workplaces. The need for Achievement also has a moderate correlation with the level of Motivational Force. Although this correlation is weaker than the other two needs (Affiliation and Control needs), it has to be noted that professionals in software engineering could be achievement-oriented and try to

overcome all their challenges (Sharp et al., 2009). However, meeting this need requires a high level of job design to clarifying task requirements, which might be measured by Goal-Setting Theory, as explained in the next stage.

Based on this finding, the construction of this study's model (version 2) will be expanded by developing Version 3, as shown in Figure 7.3.

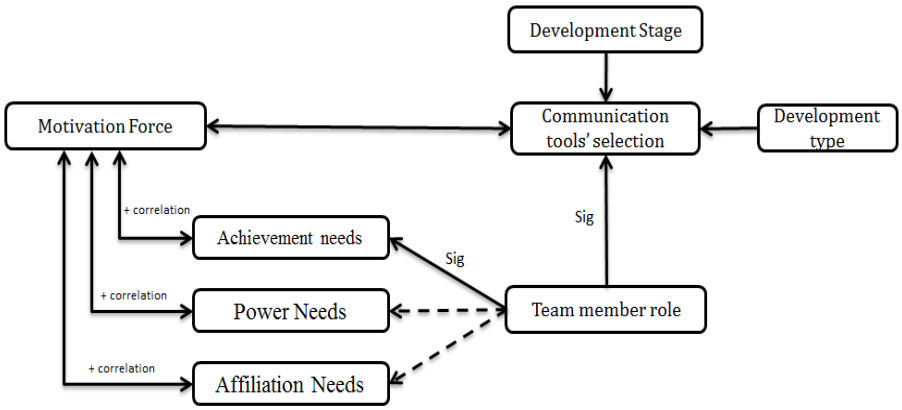


Figure 7.5 Version 3: Correlation of needs with the Motivational Force

7.4 Stage 2: Impact of Occupational Factors on Motivation in Software Engineering Environments

At this stage, the influence of three occupational factors is investigated (daily work type, contracting conditions and members' roles) on this sample's motivation level, in light of three different theories of motivation (Goal Setting Theory, Equity Theory and Self-Determination Theory).The central questions of this chapter are:

- How could these theories' application be influenced by these three factors?
- How could these theories predict the level of motivation force for professionals in software engineering settings?

The results show significant relationships and correlations as follows:

1. The application of Goal Setting Theory is not affected by daily work nature. However, this theory's elements have positive correlations with the Motivational Force level in this sample.

Three elements of Goal Setting Theory were chosen to be tested in this study which are focused on goals, receiving feedback and task clarity, in order to find out how daily

work types (project-based work or operations-based work) could influence them statistically, and how Goal-Setting Theory's elements interact with the Motivational Force level in this sample.

Results show that individuals who worked on projects are equal to those who work in daily routine operations in terms of the influence of the three elements of Goal-Setting Theory. Questions were drawn up to reflect the sample's perceptions regarding the three Goal-setting elements (commitment towards goals, receiving feedback and task clarity), and answered from both project and operations environments at the same variation level, with no significance for influencing the daily work type on their perceptions. This gives an indication that software engineering environments are managed in the same way in the two environments (projects and operations). For example, the developer who works on a project has the same feeling towards the Goal-Setting Theory elements compared to another developer works in an operational department. In the operational department, a developer works on a daily routine task, such as maintening an existing system.

In terms of the correlation with the Motivational Force level, it appeared that an increased application of Goal-Setting Theory was accompanied by another increase in the Motivational Force power. This underlines the importance of applying Goal-Setting Theory in designing any motivational model in the software engineering industry. This result supports the previous study conducted by Wu, Gerlach, & Young (2007), who found that the clarity of a project's goals and participation in helping to enhance human capital, career advancement, and personal requirement in software development could lead to a higher motivation level.

Based on this finding, the construction of this study's model (version 3) will be expanded by developing Version 4 as shown in Figure 7.6.

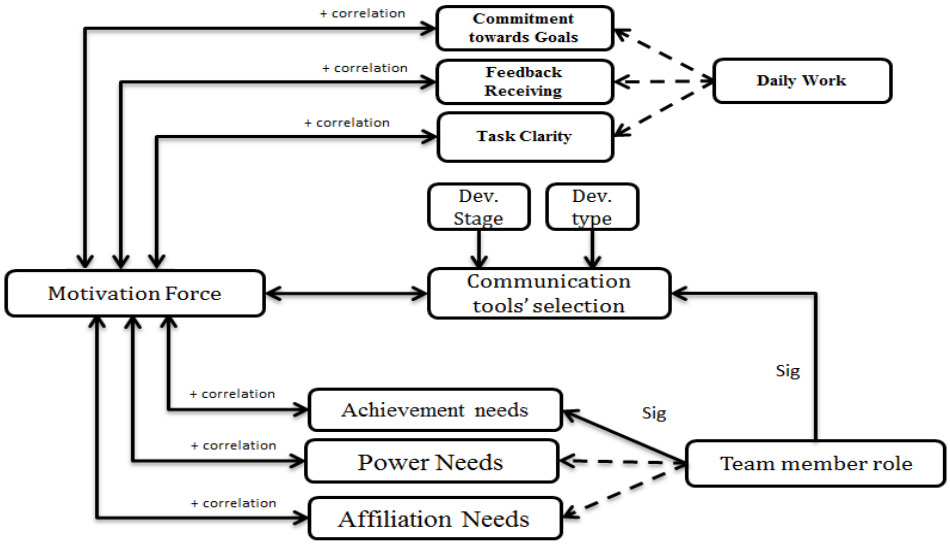


Figure 7.6 Version 4: Application of Goal Setting Theory

2. Application of Equity Theory could be influenced by the member's role factor only in the element of financial equity feeling. However, both elements of equity (Financial and Recognition equity) have a positive correlation with the Motivational Force level in the sample.

The results showed that the participants in this sample differed in terms of their financial equity feeling, based on their roles in software engineering projects. Statistical analysis revealed a significant influence of this factor for both IT managers and technical staff groups, as the mean of financial equity feeling in the technical work group is (2.34), while the means of financial equity sense in the IT managers group and Coordination staff groups are (2.78 and 2.37 respectively).This result could be explained by higher levels of salaries and financial rewards for IT managers compared to technical workers and coordination staff in software development environments. Developers and other technicians felt that they earn less than they deserve, as they see their work as being as valuable as an IT manager's work, but they get paid less, in some cases. In the long run, this feeling leads to a sense of dissatisfaction, which might cause turnover intention and withdrawal from work. Therefore, monitoring this factor is of considerable importance in software engineering environments, as the cost of resource replacement is higher than the cost of the equality or compensation. This problem could be resolved by other solutions, such as paid overtime, more training opportunities and clear career development paths.

In terms of the correlation with the Motivational Force level, the increase of the Equity Theory's two elements is accompanied by another increase in the motivational force level. This could be understood by the importance of applying Equity Theory in designing any motivational model in the software engineering industry, in order to ensure the projects' development continuity. Therefore, delivering the project in a non-problematic way, as the equity feeling level is maintained as high as possible by the project manager.

Based on the findings, the construction of this study's model (version 4) will be expanded by developing Version 5 as shown in Figure 7.7.

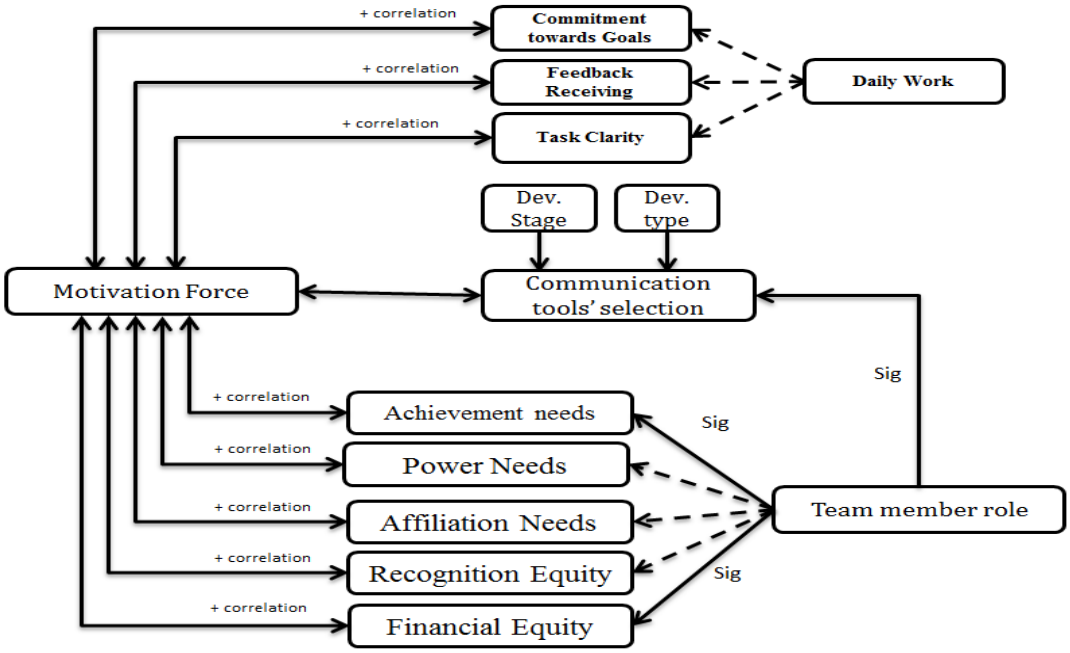


Figure 7.7 Version 5: Application of Equity Theory

3. The application of intrinsic motivation theory is not affected by contract type factor. However, intrinsic motivation is positively statistically correlated with the Motivational Force level in the sample in four out of the five elements (Perceived Choice, Perceived Competence and Value of the job and Relatedness), whereas the fifth factor (Pressure Tension) has a slightly negative correlation with Motivation Force value.

The results show that the intrinsic motivation level was equal throughout this study's sample, regardless of their contract types. Although participants in this study from

software engineering environments held different types of contracts (permanent, project-based, annual-based or even unpaid workers), they were motivated intrinsically at the same level statistically. This result showed that intrinsic motivation cannot be achieved through contracting processes. Intrinsic factors such as Perceived Choice, Perceived Competence, Value of the Job, Stress and Relatedness are very important for project managers. They should be taken into account and monitored during the project's lifecycle, in order to avoid unexpected turnover or even delay in project handover.

Regarding the Perceived Competence factor, participants, whether they were working for long or short contracts, had the same level of this factor as they thought that they were competent enough to do the job and doing their best at the current job. This could give a good indication of their self-confidence level at work, which might pave the way for more career development and enhancement.

In terms of Value of the Job factor, all participants, regardless their contract types had the same level of valuing their job and understanding that their job was important for the organisation and the community. This could be a driver for the sense of responsibility in software engineering environments.

The Relatedness factor could be seen in this study from the perspective of another theory, which is Organisational Commitment. However, the results showed that participants from different contracts had the same level of relatedness level. This could be seen as a positive indication that there were no signs of discrimination in the workplace based on the type of contract, as some workers might've felt that they had a lower level of attachment to their organisation because of their contracts' limitation or because they were working for a short period. However, it seems that the sense of collaboration and achievement has overcome any potential discrimination in software engineering environments.

In terms of the correlation with the Motivational Force level, the increase in any one of four intrinsic motivation elements (Perceived Choice, Perceived Competence, Value of the Job and Relatedness) is accompanied by another increase in motivational force power. This emphasises the importance of applying intrinsic motivation in designing any motivational model in the software engineering industry by supporting individuals and encouraging them in workplace, which in turn will increase their self-confidence level and enable them to pursue work at higher levels.

Based on this finding, the construction of this study's model (Version 5) will be expanded by developing Version 6 as shown in Figure 7.8.

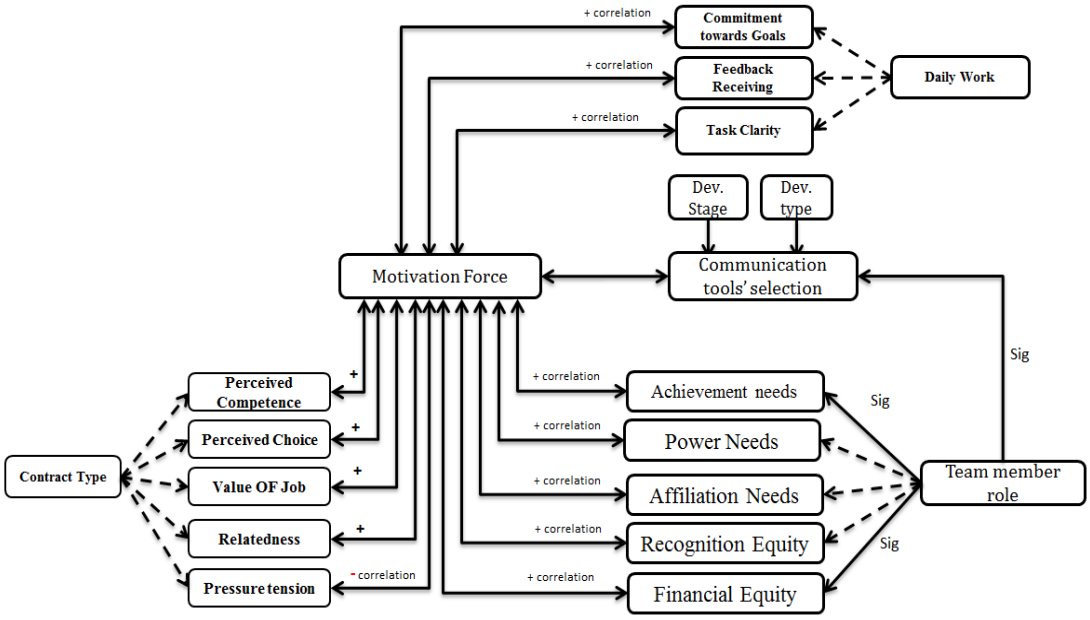


Figure 7.8 Version 6: Application of intrinsic motivation

4. Application of Extrinsic motivation theory is affected by contract type in only one extrinsic motivational element (integrated regulation). However, extrinsic motivation is statistically correlated positively with two out of four extrinsic motivational factors (identification and integrated regulations).

Results from testing extrinsic motivation's four elements showed that individuals differed in terms of their integrated regulation based on the type of their contracts. Participants who worked for the government or in projects were higher at their Integrated Regulation compared to those working either under an annual contract type or for private business. These differences occurred in their self-examination and bringing new regulations into their work values from others' values and experiences (simulating others values). This result provided a clear indication that individuals who worked for the government and the projects had a constant need for training and development, as they worked in a variety of software development projects. It is also believed that employing highly efficient and skilled manpower in software engineering will be an important investment to increase the skills of others and motivate them to perform at a higher level.

Moreover, people in software engineering could be influenced by others' values and needs, as they work in the same workplaces. Sitting beside someone who is more experienced could be an extrinsic motivation, based on these results. The results showed the positive influence of working in groups in software engineering, and how pair-programming and other techniques could be beneficial to individual motivation. This finding supports an early work in 1926 by Kohler, in the field of sports and running races (Hertel, Kerr, & Messé, 2000).

In terms of the correlation with the Motivational Force level, the increase in any one of the three extrinsic motivation's elements (identification and integrated regulation) is accompanied by another increase in motivational force power. This emphasises the importance of extrinsic motivation in designing any motivational model in the software engineering industry by increasing the awareness of work value, and supporting collaborative work, team working, knowledge sharing etc.

Based on this finding, the construction of this study's model (Version 6) will be expanded by developing Version 7, as shown in Figure 7.9.

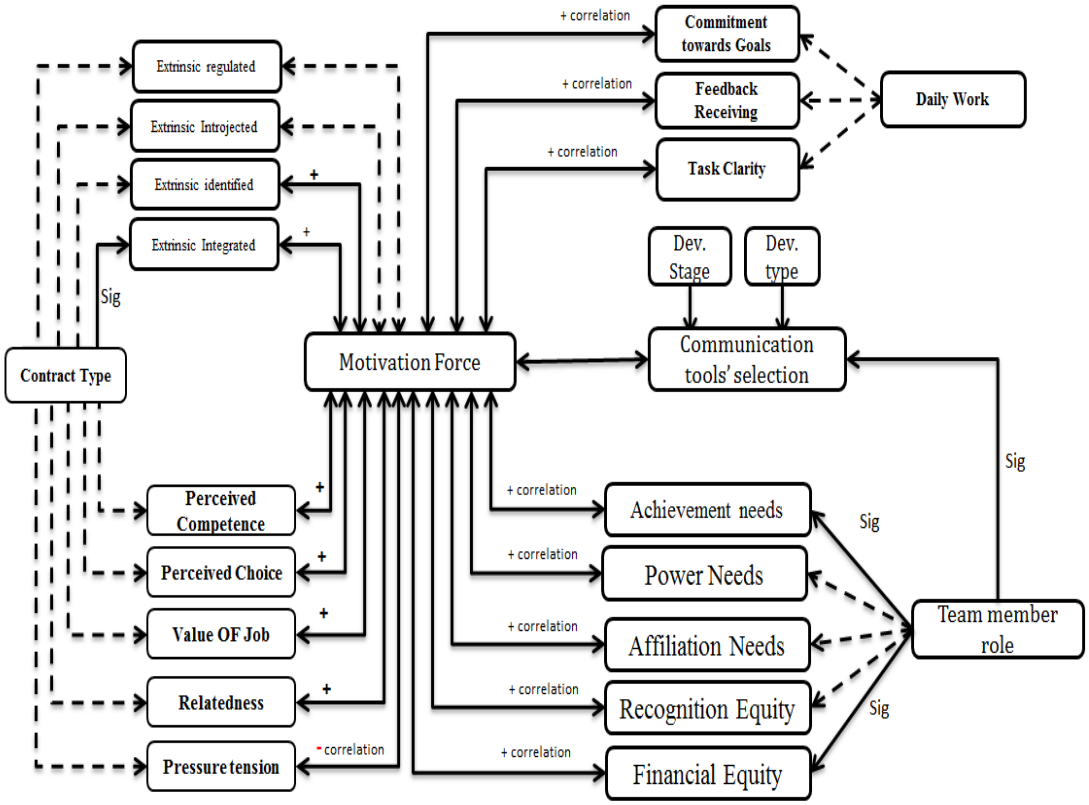


Figure 7.9 Version 7: Application of extrinsic motivation

7.5 Stage 3: Impact of Organisational Factors on Motivation in Software Engineering Environments

The influence of different organisational factors in software engineering motivation has been considered in this research literature review (see page 2-51, section 2.12).

In this group of factors, two separate studies were carried out to find out how organisational commitment and structures could shape the motivation this study's sample in software engineering environments.

The first study tests the influence of three factors (contract types, age groups, citizenship) on three types of commitment (Affective Commitment, Continuance Commitment, Normative commitment). The results of this study are displayed in Table 7.2.

Table 7.2 Summary of results of the Commitment study

	Contract types	Age groups	Citizenship
Affective Commitment	--	++	--
Continuance Commitment	--	++	++
Normative commitment	++	--	++

** Age group factor was limited to the Labour Law in Saudi Arabia as mentioned in this study's scope and limitations (page 1-3).

1. Affective commitment level in this study's sample is affected by the participants' age group.

Participants in different age groups showed statistically different types of positive feeling towards staying in their organisations. Although, this study's analysis is based on five age groups (18-24, 25-34, 35-44, 45-54 and 55-64) (see section 1.3 Research Scope and Limitations page 1-3), the most statistically significant results took place between the 45-54 group and the other two, younger groups (35-44 and 25-34). This result supports the theoretical framework introduced by Kian et al. (2012) which distinguishes personnel's attitudes in the workplace based on two groups of generations (X and Y), where generation X refers to the generation born between 1966 - 1976 and reaching the age of 36 to 46 years old in the year 2012, while generation Y is the younger generation, born between 1980 and 2000 (Angeline, 2011; William J, 2008) .

2. Continuance commitment level in this study's sample was affected by both the participants' age group and their expatriation status.

Based on this study's results, both the age group and expatriation status (called in this study "citizenship status", as working away from the home country) had a statistical influence on the feeling of being committed, because of the alternatives taking into account cost and risk.

In terms of the age groups, people age between 24 and 34 showed a statistically significant difference from the other groups, with a lower level at continuance commitment (the overall mean=2.8), whereas other groups means were (35-44 group's

mean = 3.1 and 45-54 groups mean = 4). This could indicate interestingly that the continuance commitment becomes higher as the age increases.

Citizenship status was measured in this study by asking participants whether they were working in their original countries or not. This factor was tested against the continuance commitment level. Expectedly, the results revealed that working in one's home country had a statistical impact on continuance commitment. This provided statistical support to early studies on the influence of expatriation on individuals' performance in the software information sector (Niederman, 1992).

3. Normative commitment level in this study's sample was affected by both the participants' contract type and their expatriation status.

Based on this study's results, this factor was influenced by both contract type and the citizenship situation for these participants.

In terms of the importance of contract types, the different contract types were associated with a statistically significant difference in the participants' feeling towards their normative commitment to their organisations. The most significant difference was witnessed between project-based contract holders and other types of contracts' holders. Project-based contract holders showed a higher level of obligation towards their organisations (overall mean= 3.8), compared to the other common types of contracts (Annual-based contracts' mean=3.4 and Government permanent contracts' mean = 3.2). This could deliver a critical message that working on projects, or even using project management principles could bring about a high level of normative commitment in software engineering staff.

In terms of the citizenship status, statistics showed that this factor could predict the normative commitment level in this sample. This result illustrated the differences in the obligation level between two types of workers (local workers and expatriates). The findings showed that these two groups are different statistically in their feeling towards the constraints that obligate them to stay at their organisations. Local national workers showed a lower level of obligation (overall mean= 3.38), whereas the noncitizen's group showed a higher commitment level (overall mean = 3.7). This difference could be attributed to the official obligations or contractual conditions that were signed prior to

the expatriation processes being started. However, more investigation is suggested, to clarify this finding.

Based on the findings in this study, the construction of this study's model (Version 7) will be expanded by developing Version 8, as shown in Figure 7.10.

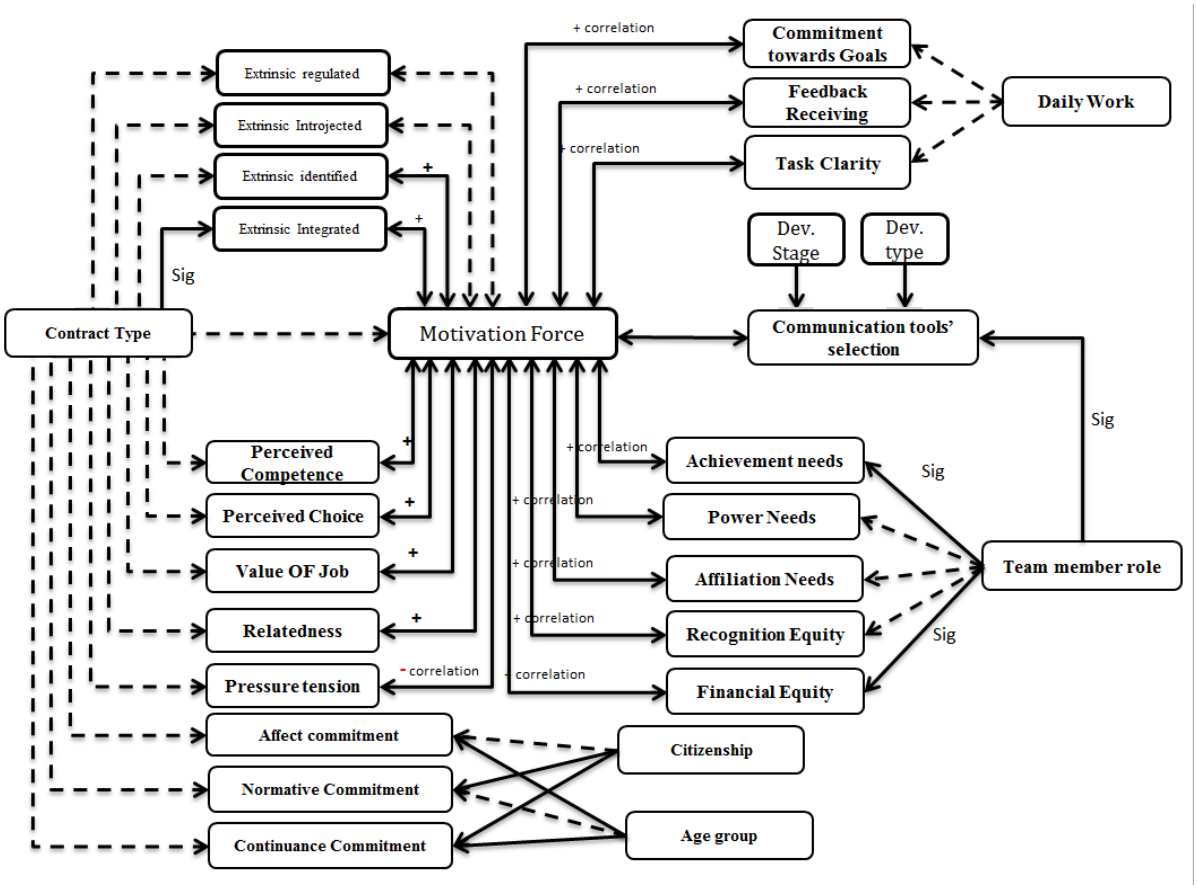


Figure 7.10 Version 8: Application of commitment theory

In the second study, the organisational structure was investigated in terms of its influence on turnover intention and other software process' problems, such as user requirement's delivery and power conflict over software engineering projects. The qualitative study revealed some significant results, showing that some organisational structures could increase the fear of project failure, and consequently, team members' intention to leave their organisations was witnessed to increase, as a pre-emptive action against any expected contract termination. This result supports the suggestion that organisational structure has a significant influence on employees performance (Chen et al., 2009), or on the software implementation process (Doherty et al., 2010) or on any type of project (Larson & Gray, 2011).

Based on the finding in this study, the construction of this study's model (Version 8) will be expanded by developing Version 9, which is the final version, as shown in Figure 7.11.

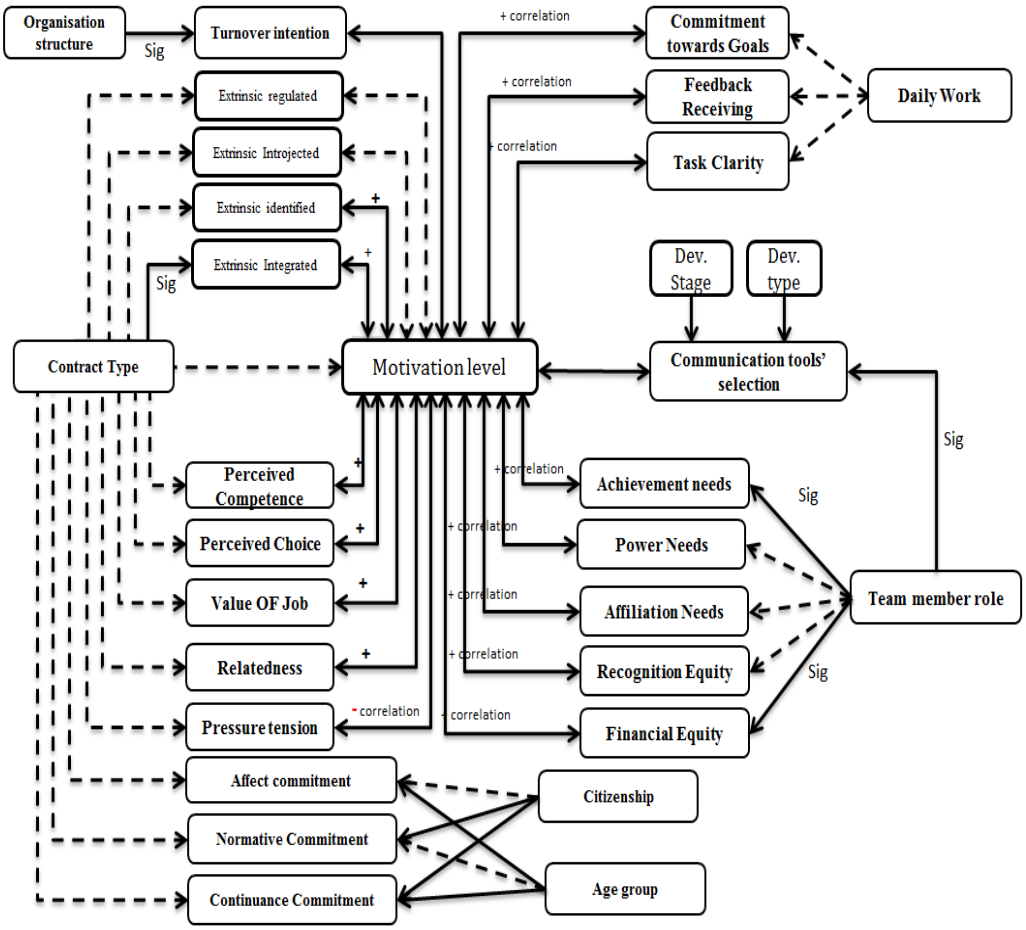


Figure 7.11 Version 9: Organisational structures and turnover intention

7.6 Stage 4: Interaction in the Software Engineering Motivation Model

This research has developed a new model of motivation in software engineering, as shown in Figure 7.11 that pulls together different motivational theories besides many factors from different levels (interpersonal, occupational and organisational levels). Hence, the findings from this research have uncovered the complexity in motivating professionals in software engineering environments.

The interaction between different types of factors was pointed out by Sharp et al., (2009) as the main reason behind the complexity of motivation, since motivation is heavily dependent on the context that it is practiced. These contexts could be split into several layers such as 'individual personality' and 'environment', and each layer could

have different impact on motivation level in the software engineering sector, as shown in Figure 7.12.

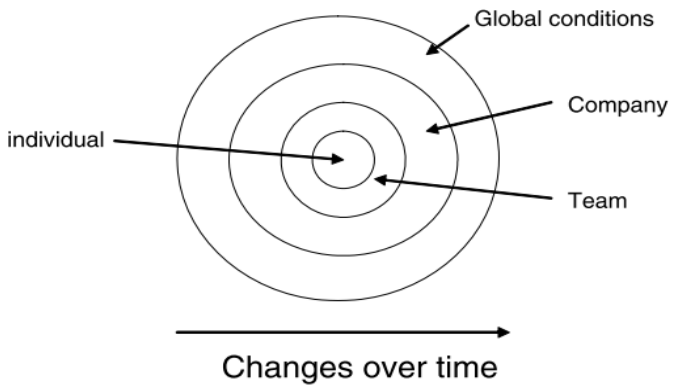


Figure 7.12 the spiral of contextual layers (Sharp et al., 2009)

As shown in Figure 7.12, the interaction of the three types of layers could be described in a spiral context in software engineering environments, each layer is suggested to have its own impact on the motivation level of the practitioners in this area. Hence, a model of motivation was constructed by Sharp et al., (2009) consisting of four principal components, which are: motivators, outcomes, characteristics and context. The model's name thus takes the initials of these components (MOCC model), as shown in Figure 7.13

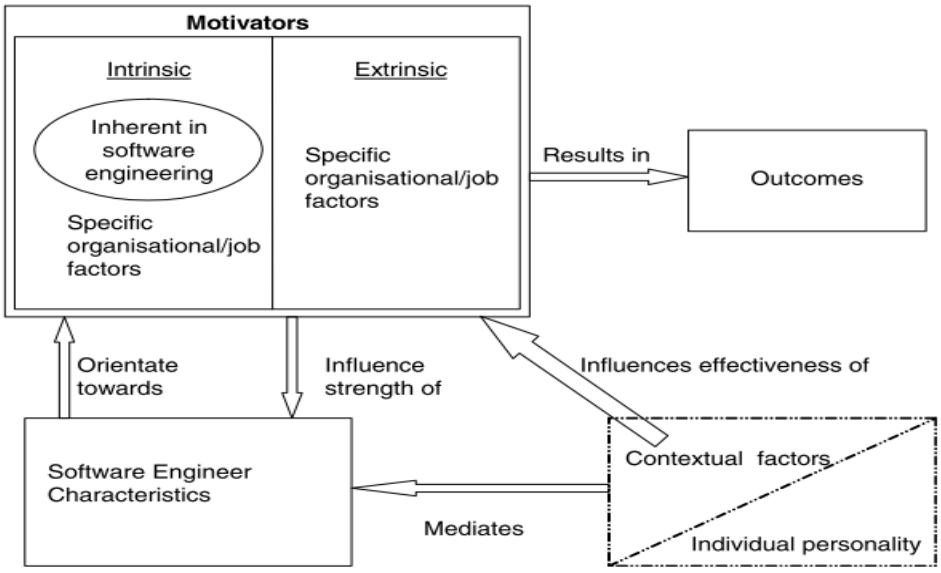


Figure 7.13 MOCC model of motivation (Sharp et al., 2009)

In this research, another approach is considered to interpret this interaction, as it has been hypothesised that the three layers of factors are overlapping rather than being in a spiral flow. Some of them influence others from a different angle, as shown in Figure 7.14 .

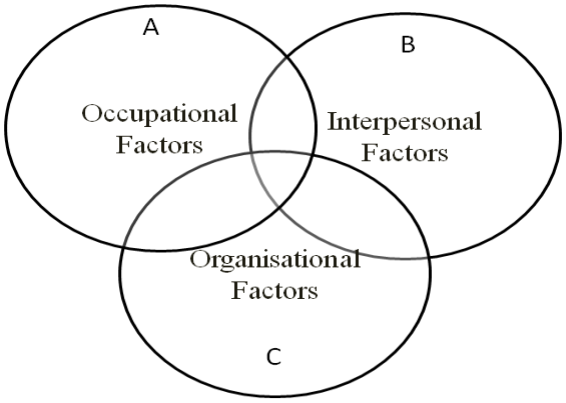


Figure 7.14 Three components overlapping

Based on the conceptualised model, as shown in Figure 7.14, the three circles (A, B and C) are constantly interacting in the workplace. The interaction between these circles has been validated throughout this thesis, especially in Chapters 4, 5 and 6. However, this interaction could be explained in steps as follows:

7.6.1 **Occupational Factors (circle A):**

These factors were tested in the light of three motivational theories (Goal setting, Equity Theory and Self-Determination Theory), as shown in Figure 7.15, these factors are distinguished from other factors by being coloured in BLACK and DARK GREY.

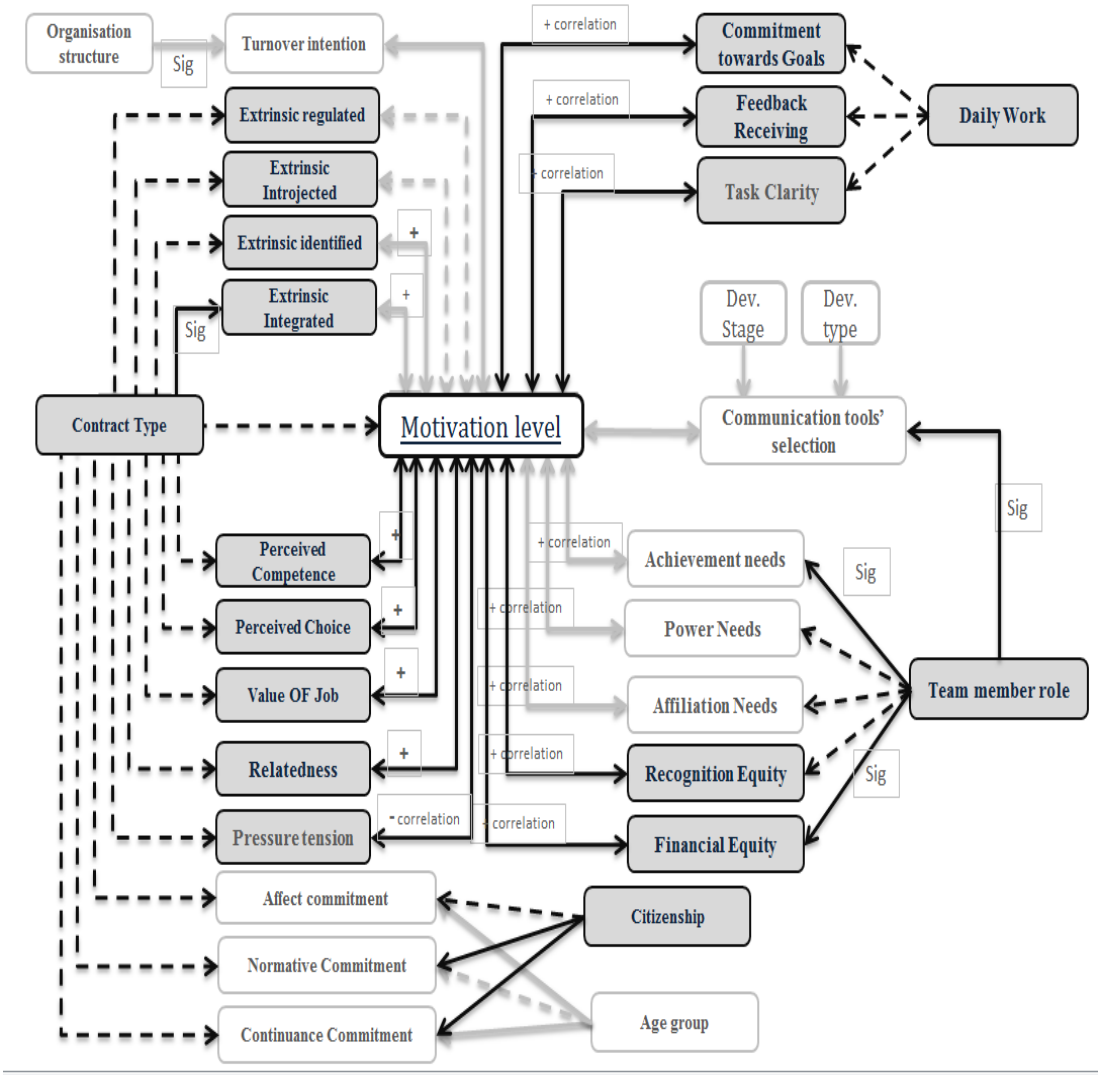


Figure 7.15 Occupational factors in the model

As can be seen in Figure 7.15, some of the identified factors are pointing directly to the Motivation Level component, which is the ultimate variable in this study, and others point towards the motivation level factor indirectly, through other factors. Therefore, these stop at the edge of other groups' factors such as:

1. Team member roles → three types of personal needs (McClelland's Theory of Achievement).
2. Team member roles → communication tools and interaction among staff.
3. Citizenship → organisational commitment.
4. Contract types → organisational commitment.

7.6.2 **Interpersonal factors (circle B):**

These factors were tested in light of two theories (McClelland's Theory of Achievement and Media Richness Theories), as shown in Figure 7.16. These factors are distinguished from other factors by being coloured in BLACK and DARK GRAY.

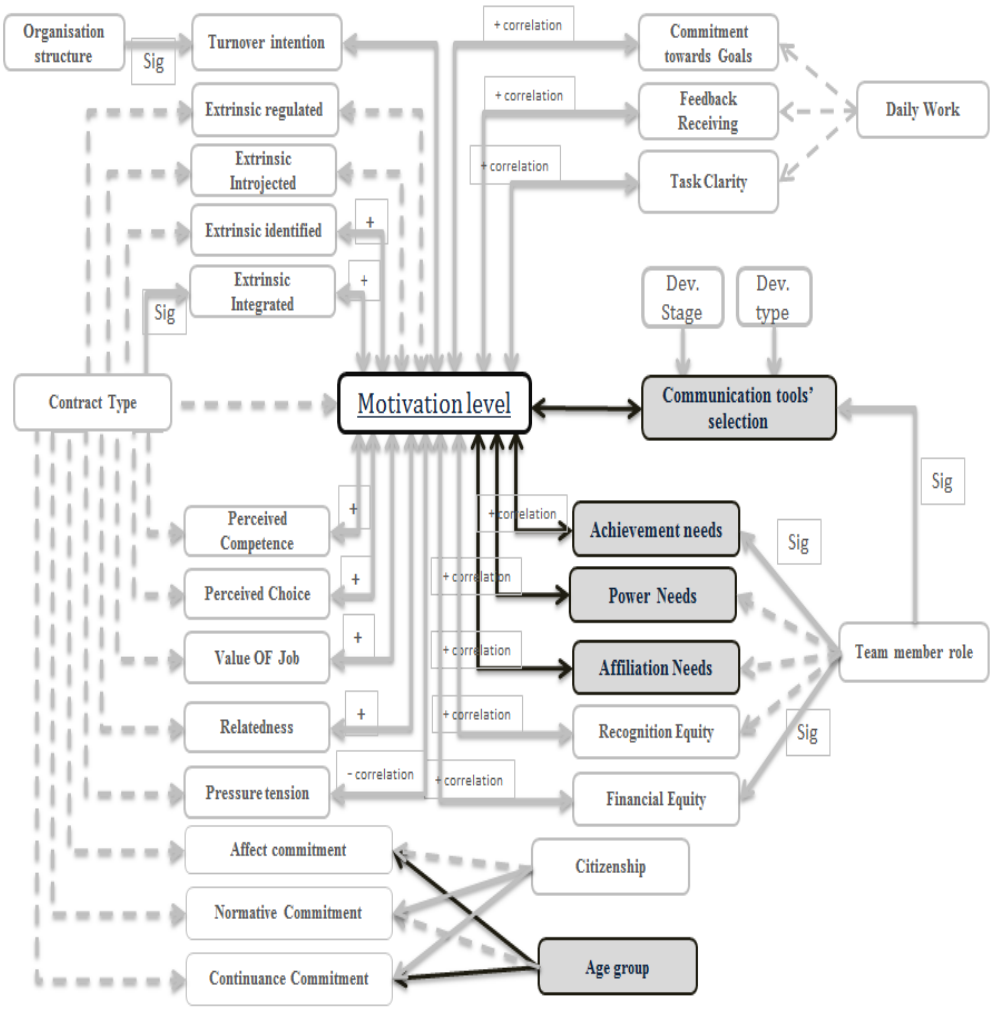


Figure 7.16 Interpersonal factors in the model

As can be seen in Figure 7.16, some of the identified factors point directly to the ultimate variable, the MOTIVATION LEVEL component, and others point indirectly towards the motivational level factor, through other factors, and stop at the edge of these factors, such as: (Age group → organisational commitment).

7.6.3 **Organisational factors (circle C):**

These factors were tested in two separate studies (organisational structures and organisational commitment) as shown in Figure 7.17. These factors are distinguished by being coloured in BLACK and DARK GRAY.

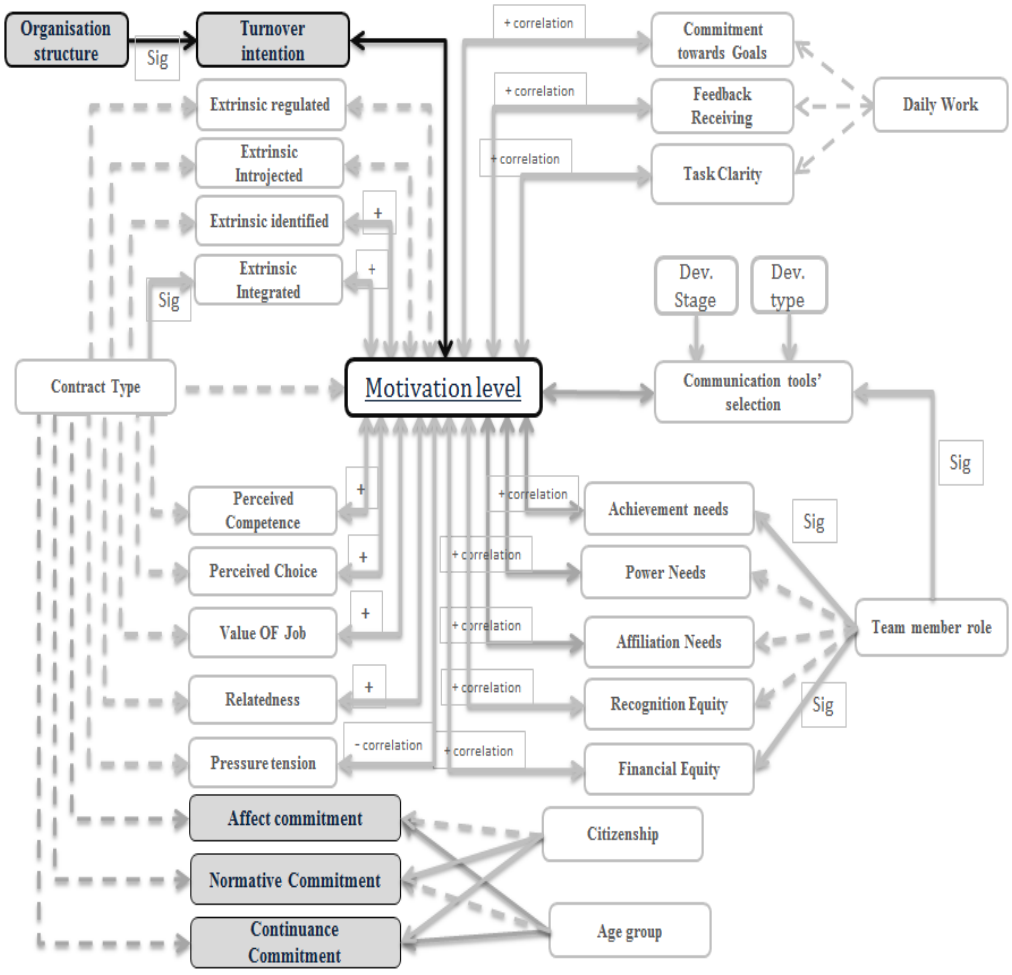


Figure 7.17 Organisational factors in the model

As can be seen in Figure 7.17, only one of these factors points directly to the MOTIVATION LEVEL component, and others are connected with the motivation level factor indirectly through other factors, stopping at the edge of other factors, such as: (organisational commitment → contract types).

In summary, the interaction between three circles (A, B and C) has been proven and validated in the model by showing that they affect the motivation level factor, whether this impact was directly or indirectly modelled.

7.7 Chapter Summary

The aim of this chapter was to discuss the findings revealed by the quantitative and qualitative approached in this research. The results were grouped into three main themes (interpersonal, occupational and organisational factors). This categorisation was adopted based on the source of each group of factors. However, it is impossible to discuss all the potential factors related to these three themes. This research has tried to monitor the motivation level in software engineering environments by combining motivation theories and some new factors observed in workplaces.

The tested factors were driven from either literature review or the preliminary study. Hence the initial research model was developed and prepared for testing. Therefore, they were discussed thoughout four stages to build the validated model of this research gradually.

In stage one, interpersonal factors showed significant positive correlation with the motivation level of this study's sample. This was proven by testing McClelland's Theory and Media Richness Theory in software engineering projects. The team member's role was shown to have a significant influence on both selection of communication tools and the achievement need factor. This could flag up the importance of this variable in software engineering. However, this group of factors could provide this definition for this study's sample:

> Individuals in software engineering are achievers but communicate differently.

In the second stage, three occupational factors (daily work type, contracting conditions and members' roles) were tested in the light of three different theories of motivation (Goal Setting Theory, Equity Theory and Self-Determination Theory). Results from this group have contributed significantly in developing this research model. The summary of these results is as follows:

1. Setting goals in both projects and operational departments in software engineering is implemented at the same level, as it is not affected by the nature of daily work. However, setting goals has positive correlations with the Motivational Force level in this study's sample. Therefore, any rewards systems in software engineering could be defective without having prepared tasks.

2. Financial equity feeling varies in software engineering based on the team member's role. Therefore, considering the monetary incentives in software engineering as the main incentive could cause some problems for the software engineering managers. However, both Financial and Recognition equity feeling have a positive correlation with the Motivational Force level in the sample.
3. Intrinsic motivation elements (perceived choice, perceived competence, value of the job, relatedness and pressure tension) are not affected by the participants' type of contract in software engineering. This highlights the need to seek other potential factors that could affect the intrinsic motivation level in order to avoid these in the workplace. However, intrinsic motivation is statistically correlated positively with the Motivational Force level in this sample in four elements (Perceived Choice, Perceived Competence, Value of the Job and Relatedness), whereas the fifth factor (Pressure Tension) has a slight negative correlation with Motivational Force value.
4. One extrinsic motivation element (integrated regulation) is affected by the type of participants' contract in software engineering. This factor reflects the importance of employing individuals with high skills and work values through different contracting conditions in software engineering, as they will influence other's motivation through their beliefs and attitudes. However, only two extrinsic motivations (identification and integrated regulation) are statistically correlated to the motivational force of this study's participants. This highlights the importance of efforts in the workplace to increase the awareness of work value, supporting collaborative work, team working and knowledge sharing.

In the third stage, two organisational studies were conducted in software engineering. The first study investigated the influence of the contracting conditions on the organisational commitment level, while the second study was concerned with the influence of the organisational structure on the motivation level of individuals who were working on software development projects at these organisations.

The results from this first study revealed that commitment has three types (Affective Commitment, Continuance Commitment, Normative commitment) and it is not possible to achieve a high level in all of them at one time, or through only one factor. Therefore, the three types of commitment should be addressed separately. All the participants from all types of contracts showed the same level of commitment except for in the normative

commitment form. Normative commitment could occur through an employees' obligation to remain at an organisation due to issues such as responsibility and binding conditions such as family, culture or even the monetary rewarding system. Therefore, contracting conditions should be reviewed and enhanced based on the perception of the normative commitment, in order to increase staff commitment in software engineering environments.

In the second part of this group, the defects in some organisational structures were found to be the real source of the turnover intention in software engineering environments, as individuals felt threatened by the failure in light of the hindrance to processes and increased conflict. This was especially evident in the functional structure, where the slow moving bureaucratic processes were witnessed and were recommended to be avoided.

The interaction between these groups of factors was explained and illustrated in Stage 4 of this chapter, thus the aim of this research was achieved.

Chapter 8. Conclusion and Future Work

8.1 Introduction

The aim of this research was to highlight the interaction between three groups of factors (interpersonal, occupational and organisational factors) in software engineering environments. This chapter summarises the entire research by detailing the conclusions drawn, findings achieved, and recommendations for further research. In addition, it identifies the main contribution to knowledge and how this research has reflected positively on the researcher's learning as a result of the whole research process.

8.2 Multi-Factor Motivation Model's Development (The main contribution)

Developing a conceptual model that illustrates the interaction of three groups of factors in motivating professionals in software engineering environments provides a wider picture for the practitioners in this field to make an appropriate decision regarding their staff performance and productivity. The main findings of the research obtained through the research phases (see Table 3.2 Research design pages 3-68) are summarised in the following sections.

The concept of the developed model is to build a model that considers the motivation in software engineering with adherence to combining all the tested factors, from different groups, and presenting these factors' roles in delivering a high motivation level to individuals who are working in software engineering.

The gradual development of the model took place in Chapter 7, by discussing the research findings in four stages as follows:

Stage 1: Impact of Interpersonal Factors on Motivation in Software Engineering Environments (see pages 7-192)

The selection of communication tools was explored and McClelland's Theory of Achievement was also tested, therefore they were added to this study's model.

Stage 2: Impact of Occupational Factors on Motivation in Software Engineering Environments (see pages 7-197)

Three occupational factors (daily work type, contracting conditions and members' roles) were explored in light of three different theories of motivation (Goal Setting Theory, Equity Theory and Self-Determination Theory). The results revealed significant associations and then added to this study's model.

Stage 3: Impact of Organisational Factors on Motivation in Software Engineering Environments (see pages 7-204)

Two organisational components (organisational commitment and organisational structure) were tested in software engineering and then added to this study's model.

Stage 4: Interaction in the Software Engineering Motivation Models (see page 7-208**)**

This stage was the main conceptual contribution to answering the central research question (see 3.3 Research Questions page 3-61), as the complexity of the motivation process in software engineering was clearly illustrated.

Based on the preceding stages, **the final validated motivation model** will be as shown in Figure 8.1. The arrows in this model are explained in Chapter 7, Table 7.1.

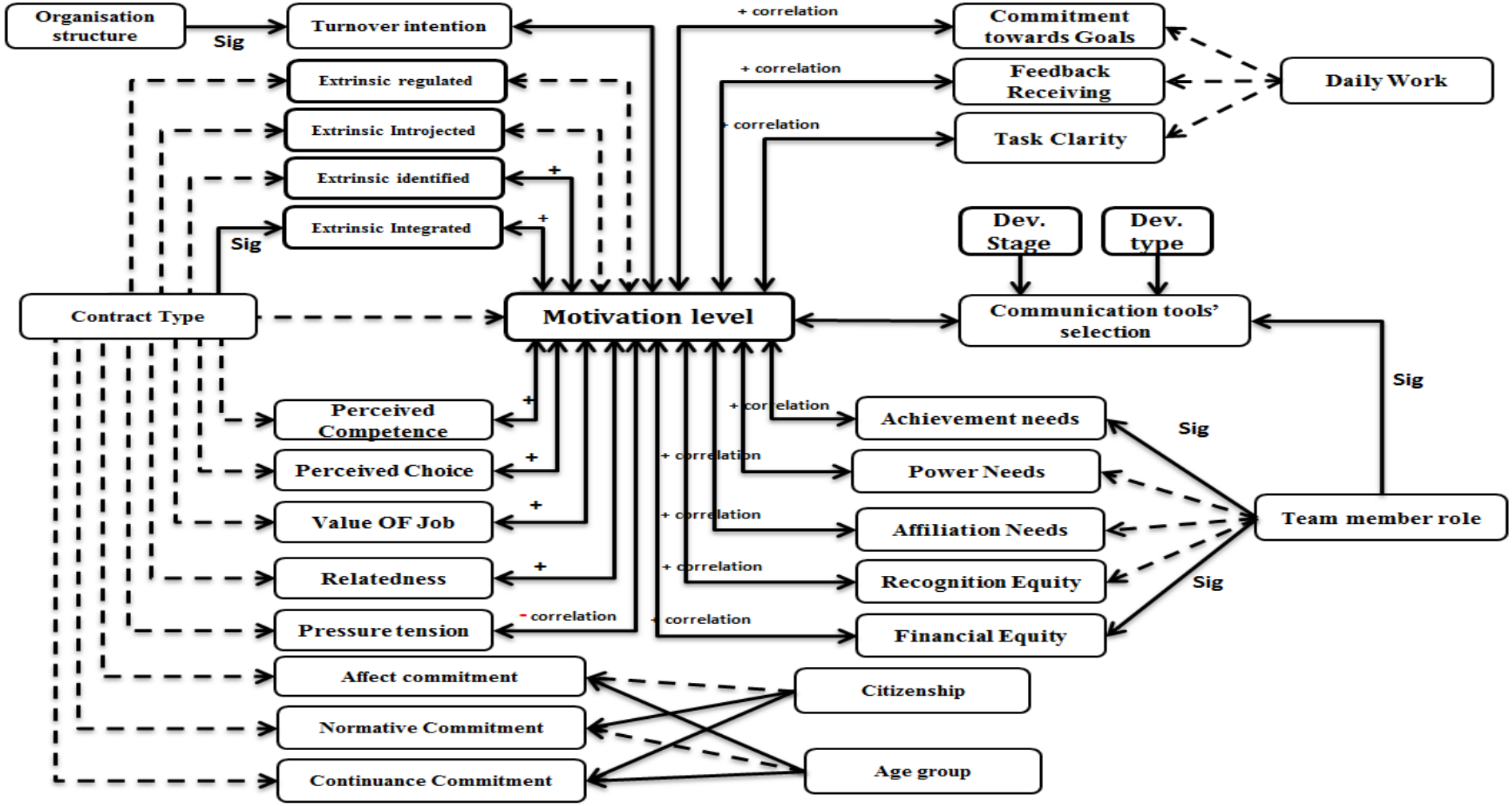


Figure 8.1 Motivational Model in software engineering

8.2.1 **Model Testing and Validation**

Different methods were used to test and validate the resultant model, because of the sensitivity and confidentiality of the required data.

In terms of the validity of the model, the questioning of the validity of this research's model is limited both by the design and the focus of the study. Therefore, five precautionary steps were followed to reach a valid model and conclusion:

1. An initial investigation with experienced software engineers was conducted in the preliminary study.
2. Personal questions were avoided and a sealed envelope was provided to put the filled surveys inside.
3. Some questions were repeated using different expressions and sentences in different places to validate the answers.
4. The sampling of these participants was random but limited to software engineering environments, as monitored by the researcher. Thus, in terms of the web-based survey, there is a question asking for the job type: one of the listed options is (I am not working in software engineering departments). Those who selected this option were eliminated from this study's sample.
5. The potential bias in the survey design was controlled by piloting the survey.
6. SPSS software was used to validate this study's model and hypotheses.
7. Post-development interviews via Skype were conducted with two software engineers in Saudi Arabia to validate the resulted model.

8.3 **Main findings of the Literature Review**

The main findings of the literature review were:

- The overlapping between three main groups of factors (organisational, occupational and interpersonal factors) was witnessed in the literature review.
- The literature shows that previous research may not have sufficiently included theories of motivation and some recent variables.
- Most of the models that were presented in the literature treated motivation in only two ways (cause→effect). More investigations and justifications were required.

- Most of the presented results were introduced a few years ago and required updating as the results could have been changed or influenced by the changes in the world economy or other external factors.

8.4 Main findings of the Preliminary Study

Phase Two of this research's design, the preliminary study, was conducted to gain an inside view of the research problem and then to help in establishing the appropriate research design.

The results of the preliminary study revealed some new factors to be investigated in the software engineering field such as (team member role, contract type, nature of the daily work, organisational structure, citizenship and age group). (See Chapter 4, Table 4.3 page 4-79).

Accordingly, an initial model was suggested to combine the results from the literature review and the preliminary study (see Figure 4.2 Initial model of the research page 4-81).

8.5 Main findings of the Questionnaire Survey

Phase Three of this research design, the questionnaire survey, was conducted to collect the data needed to investigate the research's initial model.

This phase was accomplished in five stages to reach the research aims and objectives: these stages were designed to test five motivational theories (McClelland's Theory, Equity Theory, Goal Setting Theory, Self-Determination Theory and Organisational Commitment Theory) and compare their applicability in software engineering environments to influence the Motivational Force, based on the Expectancy Theory concept. SPSS was used to validate the findings of these stages, (see Table 5.25 the five stages' results summary, page 5-164)

8.6 Main findings of the Qualitative Interviews

Phase Four of this research design, the qualitative interviews, was conducted to explore the influence of the organisational structure on the motivation level of individuals working in software engineering firms, by exploring the link between the turnover intention rate and the organisational structure of five public organisations in Saudi Arabia.

The results of this phase concluded that the motivation level of individuals working in software engineering was influenced indirectly by the fear of project failure and its consequences on their career record.

8.7 Meeting the Aim and Objectives of the Research

The overall aim and objectives of this research are presented in (Chapter 1, section 1.4 Aim and Objectives, page 1-4)

The aim of the research was to develop an updated model to motivate professionals in software engineering environments, taking into account several factors from different sources.

The aim was achieved through the process of constructing the multi-factor motivation model as discussed in Chapter 7 (section 7.6 Stage 4: Interaction in the Software Engineering Motivation Model) and presented in Figure 8.1 Motivational Model in software engineering.

Objective one is: To explore the influence of meeting different interpersonal desires and needs on the motivation level in software engineering environments.

The research process started with the literature review stage, which was to establish the theoretical background of the motivation concept and application of motivation theories in software engineering. From reviewing the literature, interpersonal interaction could be achieved through effective communication, coordination and by meeting individuals' needs in workplaces, to make them satisfied and willing to meet the work objectives.

In the preliminary study, there was a strong emphasis on team working and active communication in software engineering projects.

In the quantitative analysis, further investigation was continued by testing the three elements of McClelland's Theory of Achievement (achievement, control and affiliation) in software engineering environments. The results showed a positive correlation between levels of these three elements and the motivation level of the participants, which meant that meeting personal needs and fulfilling social needs, as mentioned in McClelland Theory, was an indispensable component in the process of motivating individuals working in software engineering environments. Therefore, focusing only on monetary rewards in software engineering can be an unworkable tool.

Objective two: To investigate the influence of different occupational factors on the motivation level of individuals in software engineering environments.

In the preliminary study, several factors emerged such as: member role, daily work nature and contracting conditions. These factors were investigated thoroughly by testing three well established theories in motivation, Goal-Setting Theory, Equity Theory and Self-Determination Theory (see 7.4 Stage 2: Impact of Occupational Factors on Motivation in Software Engineering Environments pages 7-197).

Objective three: To investigate the influence of two organisational factors (organisational structure and organisational commitment) on the motivation level of individuals in software engineering environments.

This objective was achieved through two types of analysis, quantitative and qualitative, as the nature of the data varied and required adopting two approaches. Regarding the Organisational Commitment the results showed that the type of contract did not affect the staff's commitment level in software engineering environments. However, their age group and citizenship status were found to be most influential on the commitment level in software engineering environments. Encountering this result uncovered some interesting facts about the hidden feelings of expatriates who were working outside their original countries, as they had a different level of commitment in software engineering, as discussed in Chapter 7 pages 7-204.

In terms of the organisational structure, a qualitative study (in chapter 6, page 6-185) found that the structure of the organisation could impede the software development process, and thus, flag up the possibility of project failure. This in turn, would distract the members who worked on software engineering departments from their work, and would lead them to try to find another organisation.

Objective Four: To identify the interaction between three different types of factors (interpersonal, occupational and organisational).

This objective was met by highlighting this interaction between the three main components as shown in (Figure 7.14 Three components overlapping, page 7-210). Hence, this interaction was explained in three phases (illustrated as circles in this figure), then discussed as shown in page 7-210. The discussion revealed internal associations between different factors from different groups in software engineering environments.

8.8 **Research limitations**

One of the most commonly identified problems that might affect any research's validity is "bias". According to Sackett (1979), bias could occur in research in seven different stages (1- reading up in the field. 2- specifying and selecting the study sample. 3- experimental executions. 4- in measuring outcomes. 5- in analysing the data. 6- in interpreting the results. 7- in publishing the results. Thus 65 different biases are catalogued. To reduce the potential for bias at all stages of the research, experienced researchers were invited to get involved in academic discussions to help ensure the appropriateness of the design, the reliability of the collected data, and the robustness of any interpretations made from the data. Because of these checks, the potential for bias was considerably reduced, improving the reliability and validity of the findings (Sackett, 1979).

In the qualitative part (organisational structure study, Chapter 6), the researcher is more involved in the data collection process. Therefore, the possibility of obtaining biased data increases widely. Apparently, this is not wanted and one has to be very careful not to interfere and lead the respondents in particular directions, reflecting, in this case, the interviewer's own values and beliefs. Researchers have to be objective during the process and a lot of effort has to be put into not influencing the respondents. In the quantitative part, there is always a possibility that the survey conductor meets difficulties in getting answers from the respondents, because of the confidentiality of some collected information on the matter of motivation. In these situations in the present research, the researcher put a lot of effort into assuring this study's participants about their answers' confidentiality process, in order to obtain the needed data. Moreover, the researcher avoided guiding the respondents to their answers.

Currently, these results should be considered indicative, and provide an insight into the range of thoughts, feelings and reactions of professionals in software engineering.

Future research could look to repeat and support the findings of this research, including the variation in responses provided by software engineering practitioners, with a larger sample size and using a targeted sampling method to provide wider coverage.

One of the limitations of this research is the satisfaction level and the psychological situation of the participants during the data collection period. It was noticed that some participants who were having several problems with their employers had accepted the invitation to participate in this study. This could affect the homogeneity of the answers.

This research identified a range of different variables reported by software engineering projects' practitioners as affected by organisational, occupational and personal factors in software engineering environments. However, this study could not address all the variables that could be seen in the workplace. In instances of designing reward systems where the same variables are considered, there are many other factors not mentioned in this study's model and these could be very important and must be taken into account by system designers.

The female participation rate was very low in this research because of the difficulties faced in reaching them at their workplaces. This happened because of the Saudi Arabian culture and the religious attitude for Muslims in Saudi Arabia, as it is unlikely to find females working in male sections, except in hospitals due to the necessity. This point has been addressed in this research scope and limitation page 1-3.

Contracting types and age groups factors were also driven from the work regulations of Saudi Arabia governments. This could limit other types of contracts that are being applied in many other countries. However, during the design of this research's survey the "Other" option was placed beside each categorical question in order to overcome this limitation.

The findings of this research should be viewed as indicative of the thoughts, feelings, perceptions, reflections and reactions of individuals who are working in software engineering environments in Saudi Arabia particularly. However, the findings are not inclusive enough yet to ensure the motivation in all the software engineering environments, as many other factors might become dominant in other countries or cultures.

8.9 Recommendations for Further Research

In terms of the whole research, there are a number of areas that would benefit from further research. These areas were identified throughout the progress of the research as follows:

1. The Socio-Technical Congruence value in software engineering environments was one of the attractive areas that needed more investigation, as this area had to be investigated to highlight the role of communication in software development stages. This method of study was introduced by Cataldo, Herbsleb, & Carley (2008), in which coordination between team members could be calculated mathematically. Therefore, comparing the coordination value with the motivational force value could lead to more interesting contributions in software engineering. Moreover, this could enrich the concept of the affiliation need that was explained by McClelland's Theory in software engineering environments.
2. Task distribution methods in software engineering were found to be significantly different from one firm to another. This research was trying to specify the team roles in software engineering in more detail, but the preliminary study revealed that tasks could be distributed based on several factors such as the size of the job, the deadline, the responsibility degree and other factors. This could be investigated and explained in more detail, as some techniques were found to be a threat to project stability, relying only on one developer to accomplish the project, and very soon in the practice, these are called "One-man show" techniques.
3. Re-evaluating this study's model in the future could reveal different results if the circumstances had changed for any reason.
4. Female employees have been highlighted in this research as mentioned in the Research Scope and Limitations page 1-3. Therefore, conducting this research again by considering a larger sample of females could reveal different significant contributions to the knowledge.

8.10 Generalisation of the Outcome

Generalisation of the developed model is important. However, some caution should be taken when generalising the findings of this research and drawing conclusions

applicable to all software engineering project members. This is due to the following reasons:

- Motivation could be influenced by further factors such as geographical, cultural or even organisational situations.
- This research could be affected by Saudi Arabian culture and working rules.
- Female staff weren't considered primarily in this research as mentioned in this research scope and limitation part in page 1-3.
- The thoughts, perceptions, reflections and reactions of 208 participants working in different software engineering environments, mainly in Saudi Arabia, developing various software projects using a range of tools and methodologies were canvassed.
- Good coverage by a relevant group of software engineers made the findings loosely representative. As some technical issues may not have been covered, and targeted sampling was not used, and also because behaviour differs from one organisation to another, the findings were not strictly representative. However, the results could be validated with high confidence in the next few years in similar countries to Saudi Arabia.

8.11 **Contribution to Knowledge**

The main contribution of this research is the development of a conceptual model that explains the motivation sources in software engineering environments in general. The developed model has improved and generalised the previous models that were explored in the literature review. These improvements include the following:

1. Meeting personal needs and desires increases the motivation level in software engineering, and a high level of communication and coordination leads to higher levels of motivation.
2. Individuals in software engineering are achievers more than self-needs seekers. This could be seen in the IT managers and technical workers strata.
3. Equity feeling is crucial in software engineering. However, the coordination staff group has a lower level of financial equity feeling. Alternative ways to compensate coordination staff in software engineering projects should be sought and explored since this group is crucial in implementing software projects effeciently.

4. Setting goals in software engineering projects has a strong association with the motivation level. Developing any rewards system without having goals clarified and with an identified time limit could lead to adverse consequences.
5. Employing highly skilled professionals in software engineering could increase the motivation level of others in the same workplace. This could be considered a smart investment in human resources. People in software engineering follow others who have higher values and work skills. Therefore, pair programming techniques could be a motivator if employed in this manner.
6. Commitment level in software engineering environment is influenced by age and citizenship status. This could lead to more investigation on the effect on other parts of the work, other than the motivation, for example, the quality of the work.
7. The organisational structure could initiate the de-motivation phenomenon by impeding the software development processes and taking the software engineering project into the delay and conflict areas.

8.12 **Answers to the Research Questions**

This research's 13 questions are answered as following:

- The main research question: **What does an updated model of motivation in software engineering look like, taking into account the interaction between the three factors (interpersonal, occupation and organisation)?** (this question is answered in section 8.2 Multi-Factor Motivation Model's Development page 8-217)

Q1.**What is the influence of the interpersonal factors on software engineering's motivation level?**

This question is answered in section 7.3 Stage 1: Impact of Interpersonal Factors on Motivation in Software Engineering Environments, page 7-192.

Q2.**What is the influence of the occupational factors on software engineering's motivation level?**

This question is answered section 7.4 Stage 2: Impact of Occupational Factors on Motivation in Software Engineering Environments, page 7-197.

Q3.**What is the influence of the organisational factors on software engineering's motivation level?**

This question is answered in section 7.5 Stage 3: Impact of Organisational Factors on Motivation in Software Engineering Environments, page 7-204.

Q4.**What is the association between achievement, power and affiliation needs and the motivational force value of software engineering professionals?**

This question is answered in section 5.4 Stage 1: Testing McClelland's Theory in Software Engineering, page 5-123.

Q5.**What is the influence of the team member's role on the level of three needs (achievement, power and affiliation) in software engineering environments?**

This question is answered in section 5.4 Stage 1: Testing McClelland's Theory in Software Engineering, page 5-123.

Q6 **In light of Equity Theory, what is the influence of a software development team member's role in their feeling of Equity and the Motivational Force level?**

This question is answered in section 5.5 Stage 2: Testing Equity Theory in Software Engineering, page 5-130.

Q7 **In light of Goal Setting Theory, what is the influence of the nature of daily work on the applicability of goal setting and level of the Motivational Force?**

This question is answered in section 5.6 Stage 3: Testing Goal Setting Theory in Software Engineering, page 5-136

Q8 **In light of Intrinsic and Extrinsic Motivation Theory, what is the influence of contract types on the level of software engineers' intrinsic and extrinsic motivation and on their level of the Motivational Force?**

This question is answered in section 5.7 Stage 4: Testing Self-Determination Theory in Software Engineering, page 5-142.

Q9.**What is the influence of contractual conditions on the organisational commitment level of professionals in software engineering environments?**

This question is answered in section 5.8 Stage 5: Testing Organisational Commitment Theory in SE, page 5-154

Q10.**What is the influence of age group on the organisational commitment level of professionals in software engineering environments?**

This question is answered in section 5.8 Stage 5: Testing Organisational Commitment Theory in SE, page 5-154.

Q11.**What is the impact of citizenship status on the organisational commitment level of professionals in software engineering environments?**

This question is answered in section 5.8 Stage 5: Testing Organisational Commitment Theory in SE, page 5-160.

Q12.**What is the influence of organisational structure on software development processes?**

This question is answered in section 6-181 The Organisational Structure and User Requirement Delivery, page 6-181. And in section 6.11.3 The Organisational Structure and Reporting Relationships, page 6-182

Q13.**What is the influence of organisational structure on turnover intention in software engineering environments?**

This question is addressed in section 6.11.4. The Organisational Structure and Turnover Intention Rate, page 6-183.

8.13 Reflection on Learning

This research topic was selected based on the researcher's personal interest and experiences. Reading through the motivation in software engineering and designing a new model to motivate software engineering teams has contributed significantly to the researcher's knowledge and experience, since the potential job for the researcher has a complicity of factors in software engineering projects.

Also, doing this research provided the researcher with knowledge of how to conduct academic research, including a range of knowledge related to attaining related literature, selecting a research methodology, developing a suitable structure, data collection procedures, data analysis techniques etc.

Throughout the research process, learning new academic skills could be seen clearly, as the ability to seek more knowledge improved. The literature review process necessitated the researcher to concentrate on the research questions, aim and objectives in order to find out the materials that should be considered and connected to the research model. In the meantime, the researcher was trying to balance between general reading materials and the most relevant ones, as this research requires accurate information. The literature review is a task that taught the researcher how to build an argument and how to support his views while at the same time linking the current research with the previous researches.

Using a mixed approach in this thesis gave the researcher the opportunity to learn more about the tools and instruments of both qualitative and quantitative methods. Also, during the investigation process of the research, the researcher gained knowledge, skills and experience in terms of selecting the appropriate technique of data acquisition, planning for problem solving, planning for execution, selecting the appropriate data analysis technique, and time management. It also helped the researcher to learn how to analyse and structure large amounts of data in order to reach a valid and reliable conclusion.

Being patient was one of the benefits of this research, as patience is strongly recommended in all the research processes, especially in gathering the data, broken promises from interviewing someone busy, or waiting a long time to meet one of the higher authorities in public organisations.

During the data collection, the researcher had the advantage of meeting with practitioners and experienced people who have knowledge that supported the research activities and direction.

8.14 **Publications**

Four publications in peer-reviewed journals and conferences (2 journal papers, 2 conference papers and 1 conference poster) were produced during the period while this research was being developed. These publications are described as follows:

8.14.1 How Public Organisational Structures Influence Software Development Processes: *A within-case analysis of power conflict and user requirements delivery*

(Full paper accepted in Journal of Computer Science JCS. Sept 2014)

Abstract

Software applications are developed differently based on each organisation's needs and requirements. Software projects are fundamentally based on three considerations (time, cost and quality), each of which is affected by organisational factors. Both Project Management and Software Engineering have emphasised the role of organisational structure on the quality of the deliverable software applications, recognising that organisational structure influences flexibility, reporting relationships and conflict management during the software development lifecycle. This paper reports on a qualitative study which highlights the impact of three organisational structures on software development processes in public organisations and proposes a new organisational model. Semi-structured interviews were conducted with three types of participants, a within-case analysis performed to identify themes, and as a result, a new organisational model was proposed and validated through further interviews. Outcomes showed that combining two existing structures (Functional and Matrix) into one new structure "Independent Project Management Office" (IPMO) would help to overcome administrative obstacles and conflicts in the public sector. The IPMO structure would augment the flexibility and interaction level among software development stakeholders from the perspective of organisations' leaders.

8.14.2 Re-Evaluating Media Richness Theory in Software Development Settings: Comparative Study between Agile and Waterfall

(Full paper accepted in Journal of Computer and Communications JCC, December 2014)

Abstract:

Software development teams communicate internally and externally in different ways by using a variety of communication tools. Successful communication leads to competitive software based on precise and rapidly delivered requirements, as well as rigour in bug reporting and explanation.

Agile and Waterfall software development approaches have both addressed the importance of communication for their process. However, neither Agile nor Waterfall has guaranteed communication effectiveness during their development lifecycle.

In this study, the main differences between Agile and Waterfall approaches were highlighted in the light of Media Richness Theory (MRT). The preferred communication tools were highlighted during a project's lifecycle using both Agile and Waterfall models separately. A mixed-method approach was employed in this study incorporating quantitative and qualitative data from interviews and a multilingual web-based survey. The results were presented descriptively and statistically and a rank ordering of communication tools based on the participants' preferences led to a better understanding of how to select the best tool for a given situation. Thus, a new updated MRT ranking model tailored for software development environment was developed, as well as communication tools were employed differently based on the project stages and team member's role. These differences in using communication tools could be also attributed to the type of transferable information or personal preferences.

8.14.3 The Effect of Contract Conditions and Foreignness on Software Engineers' Commitment and Psychological Contract

(Accepted as a Full paper and presentation in IADIS conference Madrid, Spain, March 2014)

ABSTRACT

The fierce competition within industrial countries throughout manufacturing and service provision has increased significantly in recent years. This has, in turn, led organisations to use multiple kinds of contractual paradigms in order to achieve their goals and objectives more efficiently. The aim of such models is to facilitate corporate progress in the desired way in terms of cost, time and quality. This study has aimed to determine the influence of such diverse contractual models and conditions on software engineers' commitments and the psychological contract. In particular, it considered their commitment towards the organisation of which they are part of, and how this is affected by the conditions of their contracts. Software engineers commitment power and psychological contract elements have been measured by a web-based questionnaire,

which was derived from TCM Employee Commitment Survey (John P Meyer & Allen, 2004) and PCI (Psychological Contract Inventory) (Rousseau, 2008) . This study was descriptive and used the statistical tools (SPSS) in order to test its hypotheses and thus achieve the study's objectives. The study sample used was drawn from closed groups such as on Facebook and LinkedIn, as well as some well-known companies in Saudi Arabia and within the United Kingdom. This was facilitated by circulating emails containing the study survey. The results have revealed that there is a considerable influence of the age of software engineers on their commitment and contractual conditions. Furthermore, the psychological contract has been the most influential factor throughout all the sample's ages. Surprisingly, foreignness hasn't had any significant effects on SE's commitment or contract conditions, however it has a significant impact on SE psychological contracts.

8.14.4 A Comparative Study of the Role of Culture & Economy in Employees' Motivation Diversity

(Accepted and presented in the 7th Scientific Saudi Conference Feb, 2014, Edinburgh UK, February 2014).

Abstract

This paper highlights the impact of economy and culture on employees' motivation levels. A comparative approach has been adopted between three well-known countries, Saudi Arabia, China and the UK. These samples were chosen based on the clearly distinctive characteristics among their economies and their cultural variations. Three datasets were used from different studies for each country, and then a non-parametrical statistical approach was followed. Both Normality test and Kruskal-Wallis test have been used to prove the diversity and the differences amongst these three datasets. Four-Drive Motivation Theory was used as the theoretical framework of this study. A combination of three data sets was split into four sub-groups. Each group should have matched each drive of the Four-Drive theory, and thus, these groups were analysed and discussed independently for the three countries based on the Four-Drive theory concept. The discussion is illustrated graphically and statistically and then the results are described accordingly.

Findings: The findings of this study were that the economic situation played a considerable role in employees' motivation. It also had an influence on the distribution of each motivation type among these countries.

Limitations: the lack of motivational studies for the selected countries was at the top of the study's limitations. This limitation led to choosing studies from different periods.

i. Appendix (A)

Name: Mohammed Bindrees

Computer Science PhD student

Supervisor: Rob Pooley

ORG ID	Date	PID

What is your gender?	1. Male ذكر 2. Female انثى	الجنس
What is your age group?	1. Younger than 18 2. 18 - 24 3. 25 – 34 4. 35 – 44 5. 45 – 54 6. 55 – 64 7. 65 or older	فئة العمر
What is your Nationality?	1. Citizen. مواطن 2. Non-citizen. مقيم	الجنسية
What is the highest level of education you have achieved?	1. Diploma دبلوم 2. Bachelor. بكالوريوس 3. MSC. ماجستير 4. PHD.دكتوراه 5. Other	آخر مؤهل علمي تم الحصول عليها ؟
Which of the following categories best describes your job?	1. IS technical (developers, networking, designers, tester .etc.) مهام تقنية بحته مثلا مبرمج – مصمم – مطور- محلل نظم – إختبار انظمة. 2. IT project managers مدير مشاريع تقنية 3. Administration work in IT dept. (dept. manager, subordinates, call center, help desk). أعمال إدارية مرتبطة	الوصف الوظيفي

	بتقنية المعلومات 4. Administrations work outside IS dept. أعمال إدارية خارج قسم تقنية المعلومات والحاسب 5. Other ……	
What is your current daily work you are doing now?	1. Operations and daily work. أعمال روتينية وعمليات دورية 2. Project member (under development). عضو في مشروع 3. Both (Projects+ operations).كلاهما مشاريع وأعمال روتينية	**طبيعة العمل اليومي حالياً**
What is your employment status?	1. Government permanent job. وظيفة حكومية 2. Annual-based Contract. عقد سنوي 3. Project-based contract. عقد على مشروع 4. Amateur هاوي بدون ارتباط رسمي 5. Other ……	**الحالة التعاقدية**
I managed to find the current job by:	1. One of my friends أحد الأصدقاء 2. Online application التقديم على الانترنت 3. Government employment التوظيف الحكومي 4. Personal searching. البحث الشخصي 5. Other ……أخرى	**استطعت الحصول على الوظيفة الحالية عن طريق:**

	strongly agree موافق بشده			strongly disagree غير موافق بشدة		
The nature of the work assigned to me is reasonable?	5	4	3	2	1	طبيعة العمل المسند لي حاليا تعتبر منطقية
I can do everything I am asked to do	5	4	3	2	1	أستطيع القيام بكافة الأعمال الموكلة إلي
I work at the required performance level in my organisations	5	4	3	2	1	أستطيع الوفاء بحد الأداء المطلوب مني
I am deeply involved in my current job	5	4	3	2	1	انا منخرط ومستمتع جدا في العمل الحالي
I believe that my current work will end up with successful results	5	4	3	2	1	انا مطمئن جدا بأن عملي الحالي سيؤدي إلى نتائج ناجحة ومفيدة لي شخصياً
I trust my supervisor and my organisation in all their promises	5	4	3	2	1	أنا أثق في وعود مديري وكذلك صاحب العمل
The delivered salary and incentives worth the expenditure of time and efforts	5	4	3	2	1	الرواتب والحوافز التي أتقاضاها حالياً تستحق الجهد والوقت المبذول
The official support is enough for me	5	4	3	2	1	الدعم الرسمي والإداري الحالي يعتبر كافي بالنسبة لي
In the workplace I get financial support higher than my colleagues are getting	5	4	3	2	1	انا أتقاضى حوافز مالية اكثر من زملائي في نفس العمل
In the workplace, my supervisor gives me more positive support and attention than my colleagues	5	4	3	2	1	مديري في العمل يعيرني انتباه واهتمام أكثر من زملائي
My job fulfils all my sociological and private needs	5	4	3	2	1	وظيفتي تملأ عليّ جميع احتياجاتي النفسية والخاصة
My job gives me an adequate financial support which covers all my family requirements	5	4	3	2	1	وظيفتي تعطيني الدعم المالي الكافي لاحتياجاتي الأسرية
Working with teams makes me more confident and capable to do more	5	4	3	2	1	العمل مع فريق عمل يجعلني أكثر ثقة وقدرة على العمل

	strongly agree موافق بشده			strongly disagree غير موافق بشدة		
This job has provided me with high management skills	5	4	3	2	1	هذه الوظيفة زودتني بمهارات ادارية عالية
I feel that I can lead our teams efficiently	5	4	3	2	1	أشعر باستطاعتي قيادة الفريق ببراعة
I can practice my leadership skills in this job	5	4	3	2	1	استطيع ممارسة مهاراتي في القيادة في هذه الوظيفة
Our working team members are collaborative and helpful.	5	4	3	2	1	نحن نعمل كفريق عمل واحد متماسك ومتعاون
I change my personal schedules in order to deliver the required task	5	4	3	2	1	أقوم بتغيير جدول أعمالي ومشاغلي الخاصة من اجل إنهاء متطلبات العمل
Completing the work tasks makes me feel more satisfied	5	4	3	2	1	إكمال مهام العمل يجعلني أكثر ارتياحاً.
I do my tasks because other people say I should do	5	4	3	2	1	أقوم بواجباتي في العمل لأن الناس الآخرين يطلبون مني ذلك
I feel guilty or ashamed when I don't do my task or miss deadline	5	4	3	2	1	أشعر بالخجل والذنب عندما لا أقوم بإكمال المهام المسندة لي في الوقت المحدد أو لا أقوم بها مطلقا.
I value the benefits of technical work	5	4	3	2	1	أنا أقدّر أهمية العمل التقني واعترف بفائدته
It's important to me to do technical support regularly	5	4	3	2	1	من المهم لي شخصيا أن اقوم بالعمل التقني بشكل متواصل بدون ملل
I think I am doing good at this technical work compared with other staff	5	4	3	2	1	اعتقد بأنني اقوم بأداء عملي بشكل جيد مقارنة بالموظفين الآخرين
I am satisfied with my performance at this technical work.	5	4	3	2	1	أنا راضي عن مستوى أدائي في العمل الحالي
I felt very tense and anxious while doing this technical work.	5	4	3	2	1	هذا العمل يجلب لي التوتر في أغلب الأوقات
My supervisor gives me more flexibility in doing tasks	5	4	3	2	1	مديري المباشر يعطيني الحرية الكافية للقيام بمهامي وانهاؤها
This is important job to do because it can reduce financial and managerial problems	5	4	3	2	1	العمل البرمجي والتقني مهم لحل المشكلات الادارية والمالية للمنظمات

	strongly agree موافق بشده			strongly disagree غير موافق بشدة		
Doing this activity could help me to ensure my future's needs	5	4	3	2	1	القيام بعملي الحالي سيساعدني في تأمين مستقبلي
I feel really close to this job	5	4	3	2	1	أشعر بأنني قريب جدا من هذه الوظيفة
I'd like a chance to interact with my supervisor more often.	5	4	3	2	1	أبحث عن فرصة اكبر للتفاعل الايجابي مع مديري المباشر
It is likely that this my supervisor and I could understand each other if we interacted a lot.	5	4	3	2	1	أعتقد بأنني ومديري سنفهم بعض بشكل أفضل عندما نتفاعل ونتحاور شخصياً
I understand exactly what I supposed to do at my job.	5	4	3	2	1	في مهامي الوظيفية , أفهم جيدا ما هو المطلوب مني عمله
There are fairly enough deadlines for accomplishing tasks and goals.	5	4	3	2	1	هناك مساحة كافية من الوقت للقيام بالأعمال المسندة إليّ
I have suitable and effective plans and tools to reaching my goals.	5	4	3	2	1	لدي خطط وأدوات كافية للقيام بكافة الأعمال
Goals are clearly explained to everyone in the organization.	5	4	3	2	1	أهداف العمل معلنة وموضحة لجميع منسوبي المنظمة التي أعمل بها.
Our managers encourage us to reach the organisation's goals.	5	4	3	2	1	المسئولين يشجعونني لتحقيق الأهداف المعلنة للمنظمة التي أعمال بها.
I accepted all the job's tasks because I know how to do it	5	4	3	2	1	قبلت العمل في الوظيفية الحالية لأنني أستطيع الوفاء بالمهام المطلوبة
My manager’s supervision and monitoring make me work more and faster	5	4	3	2	1	متابعة مديري المباشر لي تجعلني حريص على العمل أكثر وأسرع

	strongly agree موافق بشده				strongly disagree غير موافق بشدة	
I get credited and recognised when I attain the required goals.	5	4	3	2	1	أحصل على نصيب من الثناء والمديح عندما أكمل المهام الموكلة إليّ
I get feedback indicating that I have reached my goals.	5	4	3	2	1	أحصل دائما على إشعار خطي وإفادة بتحقيقي لأهدافي في العمل ومدى تقدمي في الإنتاج.
I actually feel as this organization's problems are mine.	5	4	3	2	1	أشعر حقاً بأن مشكلات هذه المنشأة التي أعمل بها تعتبر هي مشكلاتي الشخصية
I owe a great deal to my organisation.	5	4	3	2	1	أشعر بأنني مرتبط بهذه المنظمة عاطفياً وأشعر بَأننا أسرة واحدة
This organization has a great deal of personal meaning for me.	5	4	3	2	1	هذه المنظمة تعني لي شخصيا الشيء الكثير
It would be very hard for me to leave my organization right now, even if I wanted to.	5	4	3	2	1	من الصعب جداً بالنسبة لي ترك هذه المنظمة حالياً حتى وان تيسر لي ذلك.
I feel that I have too few options to consider leaving this organization.	5	4	3	2	1	اشعر بأن لدي خيارات قليلة جدا لكي أقرر ترك هذه المنظمة
One of the few negative consequences of leaving this organization would be the scarcity of available alternatives.	5	4	3	2	1	أحد النتائج السلبية من ترك العمل الحالي هو ندرة البدائل المتاحة والناسبة
Keyboards sound from colleagues makes me more motivated	5	4	3	2	1	سماع صوت لوحة المفاتيح لزميل يعمل بجانبي يدفعني للعمل والمنافسة

	strongly agree موافق بشده			strongly disagree غير موافق بشدة	
I would not leave my organization right now because I have a sense of obligation to the people in it.	5	4	3	2	1	لا أرغب ترك مقر عملي الحالي لأنني أشعر بشيء من الالتزام للناس الموجودين فيها.
This organization deserves my loyalty.	5	4	3	2	1	هذه المنظمة التي أعمل فيها تستحق إخلاصي وولائي لها.
I would be jubilant to spend the rest of my career with this organisation.	5	4	3	2	1	
Generally: The work environment is satisfactory for me	5	4	3	2	1	بشكل عام : مناخ العمل الحالي يعتبر مرضي بالنسبة لي
Generally: This job is unsecured	5	4	3	2	1	بشكل عام : الوظيفة الحالية غير آمنه
Sitting beside someone who has experience more than me can motivate me	5	4	3	2	1	الجلوس الدائم مع موظف/ مبرمج أكثر مني خبرة يحفزني للعمل بشكل أكثر
I feel that I am motivated when I see others working very hard	5	4	3	2	1	أشعر بالدافع الداخلي للعمل بشكل أكثر عندما أشاهد الآخرين يعملون بجد
Internal design and work environment make me more motivated	5	4	3	2	1	التصميم الداخلي للمكاتب وجو العمل يجعلني محفز للعطاء أكثر
Quietness and silence make me more motivated	5	4	3	2	1	الهدوء والسكينة في محيط العمل يحفزني للعطاءأكثر

I intend to leave my current employer **أنوي ترك العمل الحالي** *(اختر واحدة فقط)*			
1	In less than a year	أقل من عام	1
2	After 2 to 3 years	مابين عامين إلى ثلاثة	2
3	Once I received higher salary or position offers	بمجرد الحصول على عرض أفضل من حيث الراتب او المركز	3
4	I am not intending to leave my current employer	لا أرغب في ترك عملي الحالي مطلقا	4
5	I cannot leave this employer because of the government's rules	لا أستطيع ترك العمل الحالي بسبب الأنظمة الحكومية	5
6	Other	اخرى	6

I currently receive incentives as: **أنا حاليا أتقاضى حوافز على النمط التالي:**			
☐	Motantory on the top of my salary	مالي إضافي على الراتب	☐
☐	Recognition certificates regularly	شهادات شكر بشكل منتظم بدون مالي	☐
☐	Motantory and recognition	مالي مع شهادات شكر	☐
	I am not receiving any incentives at the moment	لا أتقاضى أي محفزات حالياً	☐
☐	Other ……..	اخرى	☐

Reasons that will cause you to consider to leave the organization **أسباب ستجعلني أقرر ترك العمل الحالي** (بالامكان اختيار أكثر من واحدة)			
☐	Insufficient Payment	غير كافية مالياً	☐
☐	Lack of Career Advancement	ضعف التطوير الوظيفي	☐
☐	Work Load	أعمال كثيرة متعبة واوقات طويلة	☐
☐	Interpersonal relationships	العلاقات مع الزملاء	☐
☐	Shift Patterns	نظام الشفتات وساعات العمل	☐
☐	Working Conditions	ظروف وأجواء العمل	☐
☐	Benefits	الفوائد والمصالح الصخصية من العمل	☐
☐	Management style	أسلوب الإدارة المستخدم لايعجبني	☐
☐	Location	موقع العمل الحالي	☐
☐	Others	أخرى تذكر.....	☐

Any Comments:..... (كلمة أخيرة) كيف ترغب أن يكون التحفيز في إطار تطور المشاريع التقنية (اختياري مفتوح)

Your email address (optional for thanks letter) ..... بريدك الالكتروني (اختياري لإرسال خطاب شكر على مساهمتك)

Thank you so much for participating in my survey شكرا جزيلا لمشاركتك القيمة وأتمنى لك التوفيق في حياتك العملية

Mohammed Bindrees محمد الدريس

ii. Appendix (B)

Interviewer : Mohammed A Bindrees
Heriot Watt University
Mb336@hw.ac.uk
June 2013

Interview Form نموذج مقابلة شخصية

Date and time		التاريخ
Interviewee name		الاسم
Organisation name		اسم المنظمة
Job		الوظيفة
Question 1	ما هي الأشياء التي تحفزك في العمل ؟ What motivates you (and your staff, if he is a project manager)?	السؤال الأول
Notes and comments		ملاحظات
Question 2	هل تعتقد ان الناس مختلفين في تحفيز هم؟ ولماذا؟ Do you think that people can be motivated differently? If YES please say why?	السؤال الثاني
Notes and comments		ملاحظات
Question 3	مالذي يجعلك غير محفز ؟ What makes you de-motivated?	السؤال الثالث
Notes and comments		ملاحظات
Question 4	الى أي درجة تعقد ان المحفزات التالية مهمة To what extent do think these factors are important in motivating people in software engineering environments? Rate as the following: (3 Important - 2 Natural -1 Not Important - 0 I don't know)	السؤال الرابع

Interviewer : Mohammed A Bindrees
Heriot Watt University
Mb336@hw.ac.uk
June 2013

List of motivators المحفزات

		rate				
	Motivators list	0	1	2	3	
1	Rewards and incentives					المكافآت والجوائز
2	Development needs to be addressed					احتياجات العمل والتطوير والبرمجة
3	Variety of work					تنوع العمل
4	Career path					الطور الوظيفي
5	Empowerment/responsibility					الاحساس بالمسؤولية
6	Good management					الادارة الناجحة
7	Sense of belonging/supportive relationships					الشعور بالانتماء للمنظمة والدعم
8	Work/life balance					موازة العمل والبيت
9	Working in a successful company					العمل في شركة ناجحة
10	Employee participation/involvement/working with others					مشاركة العمل مع الموظفين والعمل ضمن فريق
11	Feedback					التغذية الراجعة في العمل
12	Recognition					الاطراء والثناء
13	Equity					العدالة
14	Trust/respect					الثقة والاحترام
15	Technically challenging work					الأعمال التقنية ذات طاب التحدي
16	Job security/stable environment					الأمان الوظيفي وبيئة العمل
17	Identify with the task					التواؤم مع المهام المسندة
18	Autonomy					الاستقلالية
19	Appropriate working conditions/ environment/ good equipment/tools/physical space/ quiet					ضروف العمل المناسبة وتوفر الأدوات اللازمة والمعدات
20	Making a contribution/task					الفوز في تحديات العمل والاسهام والبروز

Interviewer : Mohammed A Bindrees
Heriot Watt University
Mb336@hw.ac.uk
June 2013

	significance					
21	Sufficient resources					اكتفاء الاداوات
22	Team quality					جودة الفريق
23	Creativity/innovation					الابداع والابتكار
24	Fun					المرح
25	Professionalism					التفوقية والاتقان
26	Having an ideology					المثالية
27	Non-financial benefits					محفزات غير مالية
28	Penalty policies					الغرامات والجزاءات
29	Good relationship with users/customers					العلاقات الجيدة مع المستخدمين والعملاء

Thank you for participation

شكرا لك على المساهمة وقبول الدعوة للمشاركة

Mohammed Bindrees

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iii. Appendix (C)

Preliminary study interviews transcription summary

Demographical data:

#	Role	nationality	Age	Company	Duration
Intrev.1	Proj manager	Saudi Arabian	39	Elm sa	15 mins
Intrev.2	Proj manager	Jordanian	45	Ministry of Education	18 mins
Intrev.3	Proj manager	Indian	44	Ministry of commerce	20 mins
Intrev.4	Developer	Jordanian	36	Elm sa	22 mins
Intrev.5	Developer	Indian	32	Ministry of commerce	20 mins
Intrev.6	Developer	Jordanian	32	Techno Wave Saudi Arabia	22 mins
Intrev.7	Analyst	Jordanian	52	Elm sa	20 mins
Intrev.8	Coordinator	Saudi Arabian	28	Ministry of Education	18 mins

Summary of the recorded interview

Question 1# What motivates you (and your staff, if he is a project manager)?

Answers #

Interviewee	answers	**comments**
Interv.1	**Respondent:** Many things, money is not important, training, respect, promotions, everyone has something different motivate him. For me, I thing training, and promotions. **Interviewer:** What about money? **Respondent:** not that much important to me personally.	
Interv.2	**Respondent:** Job security first, respects from the high authority, money is also important but not on the top. **Interviewer:** Do you feel that you are in a risk in terms of your job? **Respondent:** Yes I do as long as my contract will expire by the end of the project. I am not Saudi employee. **Interviewer:** What if your contract will be terminated in few months,	Contracting and commitment issues. Citizenship. Financial support

	what would you do? **Respondent**: I will be busy by finding another company or project. **Interviewer:** What about money? **Respondent:** yes of course it is on the top every where	
Interv.3	**Respondent**: Good plans of projects, payment on time, high salary of course for the best staff only. Working in teams as a project. **Interviewer:** What do you mean by good plan? **Respondent** :I mean clear tasks and user requirements, I hate reworking on the same pages. **Interviewer: what makes the requirements unclear?** **Respondent:** there are many reason, but the bureaucratic process and the organisation hierarchy causes a delay in project requirements. **Interviewer** Is that because you work for a governmental project? **Respondent** : Could be yes	Tasks clarity issues. Organisational structure
Interv.4	**Respondent**: Ongoing training, respect from project manager, valuing the work, working times flexibility, working alone. **Interviewer:** why do ask for respect? **Respondent**: because some of them don't respect your personality and if I objected that would lead to my contract termination. **Interviewer:** What if he didn't respect you? **Respondent**: I will move to another project asap. **Interviewer:** What about money? **Respondent:** yes of course it is important, but job security is more important to me.	Contracting issues Commitment issues
Interv.5	**Respondent**: High salary, job security, contract auto renewal, clear goals. **Interviewer** What if your manager refused to give high salary, but more recognition? **Respondent** I will definitely move to another company **Interviewer** Why? **Respondent** I am a skilled developer and DBA, and can sign another contract very fast.	Financial issues, Contracting issues Task clarity Contracting issues.
Interv.6	**Respondent**: Involvement in making the decision, respect, sharing the benefits, good communication. **Interviewer:** What do you mean by benefits?	Equity issues. Roles issues.

	Respondent: I mean the extra financial incentives that goes to the project managers , Although I am who did the work actually	
Interv.7	**Respondent**: Clear tasks and deadlines, money, long contract, involvement in decisions.	Task clarity Financial issues, Contracting issues
Interv.8	**Respondent**: Money, job promotions and training	Financial issues,

Question 2# Do you think that people can be motivated differently? If YES please say why?

Respons e	Answer	comments
Interv.1	**Respondent**: Yes of course, Saudi people are motivated differently as they are looking for more promotions and recognition, but other nationalities always looking for higher salaries and job security. **Interviewer:** Why Saudi people particularly? **Respondent**: Because they work for the government mostly, and feel their jobs are secured.	Citizenship issues. Contracting issues.
Interv.2	**Respondent**: Yes, based on the productivity they get higher promotions and salaries. **Interviewer:** What if they cannot produce at the same level? **Respondent**: Yes, that could happen at the elderly people as they are quite slower than the young people, however, they more stable at the work, and we can rely on them in the long projects. Therefore, we motivate them as well.	Roles issues. Age issues
Interv.3	**Respondent**: Yes of course, some of them can be motivated easily and some is difficult to get him motivated **Interviewer:** Why? **Respondent**: For many reasons, some of them have difficult circumstances in his life, always introverted (fuzzy), some of them just need a day or two off, and then he will be highly motivated. **Interviewer: How about their roles and jobs, are they motivated equally?** **Respondent**: Yes to some extent, that could happen if the reward system	Personal needs and consideration issues. Roles and job types

	is not clear or hasn't been set properly.	
Interv.4	**Respondent**: At some point Yes, as I have seen many motivated people without obvious reason. Although they weren't the highest salary in the workplace. **Interviewer:** What do you think makes them different? **Respondent**: I think they are more confident in terms of their technical ability, they have good relationship with the high authority, and they have some power in the work to get what they want in terms of the vacations and training.	Power conflict issues. Equity issues.
Interv.5	**Respondent**: Yes sure they are different, each type of people require different motivators, for example, help desk staff require some recognition to be in the same level of technical staff. And non-citizen people require more assurance terms of their visa validity and contract renewals.	Role issues. Citizenship issues.
Interv.6	**Respondent**: I think there are no differences between people; the differences are in the way of giving these incentives. People are the same, but the leaders treat them differently. I need to do more with people and create good relationship with them to be known to the organisation's leaders, to be motivated properly.	Organisational hierarchy issues, Equity issues.
Interv.7	**Respondent**: Yes of course there are some differences. I can see older people in this organisation take more than others,	Age issues.
Interv.8	**Respondent**: Yes of course, I can see that non-citizen people are receiving more incentives than us, although we work at the same level of productivity. I am a citizen and should be treated better.	Citizenship issues, commitment issues.

Question 3# What makes you de-motivated?

Answers #

Response	Answer	comments
Interv.1	Working for small projects or routine duties.	Operation and projects

		issues
Interv.2	Unclear requirements, lack of financial support,	Task clarity
Interv.3	Operational work and routine, poor communication.	Daily work type
Interv.4	Lack of recognition, noise in workplace. Working for mismanaged projects, unclear job	Daily work type. Task clarity
Interv.5	**Respondent** Stress, family problems, delay in requirements , conflict with others in work **Interviewer** Why conflict? **Respondent** Some people are causing technical problems and delay in project handover, which at the end puts some blaming on me as a developer. **Interviewer** What do you need to solve this problem? **Respondent** I need to jump them all and speak directly to the user to get the right requirements.	Personal needs. Organisational heirarchy
Interv.6	**Respondent** Lack of financial support, poor coordination and also the delay in project implementation. **Interviewer** Why there is a delay? **Respondent** Long procedures and processes to get the project approved and the requirements validated	Financial support
Interv.7	The work itself , sometimes I work for an interesting project , but other times I do some disappointing operational work and routine.	Operation and projects issues
Interv.8	**Respondent** Inequity in workplace, Not being involved in the project **Interviewer** Why? **Respondent** Because my job is not a technical	Equity issues

Question 4# To what extent do think these factors are important in motivating people in software engineering environments? Rate as the following:

(3 Important - 2 Natural -1 Not Important - 0 I don't know)

		Interviewee no.								
	Motivators list	1	2	3	4	5	6	7	8	
1	Rewards and incentives	3	3	3	3	3	3	3	3	
2	Development needs to be addressed	2	3	3	3	3	3	2	3	
3	Variety of work	3	2	2	3	3	3	3	2	
4	Career path	3	3	3	3	3	3	3	3	
5	Empowerment/responsibility	2	2	2	1	1	2	2	3	
6	Good management	3	3	2	3	3	3	2	3	
7	Sense of belonging/supportive relationships	1	2	2	2	1	3	2	3	
8	Work/life balance	1	0	0	3	3	2	3	1	
9	Working in a successful company	2	3	2	3	3	3	3	3	
10	Employee participation/involvement/working with others	3	2	2	3	3	3	3	3	
11	Feedback	2	3	2	2	3	3	3	2	
12	Recognition	3	3	3	3	3	3	3	3	
13	Equity	2	3	3	3	3	3	3	3	
14	Trust/respect	3	3	3	3	3	3	3	3	
15	Technically challenging work	3	2	3	2	3	3	2	0	
16	Job security/stable environment	3	3	3	3	3	3	3	3	
17	Identify with the task	3	3	3	3	3	3	3	3	
18	Autonomy	3	2	2	3	3	3	2	2	
19	Appropriate working conditions/ environment/ good equipment/tools/physical space/ quiet	3	3	3	3	3	3	3	3	
20	Making a contribution/task significance	3	3	3	3	2	3	2	1	
21	Sufficient resources	2	3	3	3	3	3	3	2	
22	Team quality	3	3	3	2	3	3	2	3	
23	Creativity/innovation	2	2	3	3	2	2	2	1	
24	Fun	1	2	2	2	3	2	1	1	
25	Professionalism	3	2	3	2	3	3	2	0	
26	Having an ideology	0	0	1	1	0	2	1	1	
27	Non-financial benefits	2	3	2	2	2	2	2	3	
28	Penalty policies	1	1	1	1	1	1	1	0	
29	Good relationship with users/customers	3	3	3	2	2	2	3	3	

iv. Appendix (D)

Preliminary Study : Audio-taped interview transcription

Date	**15-6-2013**
Duration	**15 minutes**
Place	**ELM company for Information Technology**
Interviewees	**Eng Ibrahim Al muhteb**
Job	**Project manager**

(Interviewee 1)

Interviewee No. 1#	
Interviewer	Hi Eng Ibrahim , how are you?
Respondent	Fine thank you , yourself?
Interviewer	Good, I just want to ask you about things that keep you motivated in the workplace all the time , or even your team
Respondent	Well, that a big questions because there are many could motivate us as a team , me and my team are looking for more training , development and obtaining the new certificates in Software Engineering.
Interviewer	Does your company offer you proper training opportunities?
Respondent	Yes, but not too much, we need to patients to get good internship opportunities, as we have so many work to be done, and our high authority a bit worried of the delay
Interviewer	What else can motivate you?
Respondent	Some of my staff are looking for money , but the majority are not, they need some respect , and new positions
Interviewer	Why do you think they don't need money?
Respondent	Basically, their salaries are quite high, and they are satisfied with it, some staff who is paid low salaries try to increase their income as much as they can. But personally , money is not important to me
Interviewer	Let's talk about point you raised, which is people are different in responding to their motivators, why do you think they are different?
Respondent	Yes of course they are different based on many things, I can see that Saudi people are motivated different from other nationalities, as they are looking for more promotions and recognition, but other nationalities always looking for higher salaries and job security.

Interviewer	Is that because the low salaries?
Respondent	Yes, and also non-citizen people are working for a short period of time, and they are here mainly for money.
Interviewer	Why we don't say that Saudi people also looking for money ? why Saudi people particularly?
Respondent	Yes, Because Saudi staff are covered by the government employment rules , no fear of contract termination, and more settled as they feel that their jobs are secured.
Interviewer	Let talk about things that make you de-motivated, annoyed or even thinking of leaving the job?
Respondent	For me, I like working for big projects, meeting high authorities and presenting my skills in front of other, and this is what happening now, but this situation has changed , I would consider leaving this job.
Interviewer	Do you think that in one day you will be working for small projects?
Respondent	SO far we have one big project with high support, but once this project is finished , there is no seen project in the future , maybe there and maybe not.
Interviewer	Could you please have a look at these list of factors, and let me know about there importance in the workplace.

v. Appendix (E)

Interviewer : Mohammed A Bindrees
Heriot Watt University
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June 2013

Interview Form نموذج مقابلة شخصية

(Layer A) decision makers and high authorities

Date and time		التاريخ
Interviewee name		الاسم
Organisation name		اسم المنظمة
Job		الوظيفة
Question 1	To What extent do you think that software development projects are challenging and very important?	السؤال الأول
Notes and comments		ملاحظات
Question 2	How projects are managed in your organisation? which structure does your organisation adopt?	السؤال الثاني
Notes and comments		ملاحظات
Question 3	Do you support Software development projects? How?	السؤال الثالث
Notes and comments		ملاحظات

Thank you for participation

شكرا لك على المساهمة وقبول الدعوة للمشاركة

Interviewer : Mohammed A Bindrees
Heriot Watt University
Mb336@hw.ac.uk
June 2013

Interview Form نموذج مقابلة شخصية

(Layer B) IT managers

Date and time		التاريخ
Interviewee name		الاسم
Organisation name		اسم المنظمة
Job		الوظيفة
Question 1	What kind of services and projects that you are working on now? Who is the end user? ماهي الخدمات والبرامج التي تقدمونها ؟ ومن هو المستفيد منها ؟	السؤال الأول
Notes and comments		ملاحظات
Question 2	Could you please state the obstacles that you are facing in your projects? What is the impact of these problems? ماهي العقبات التي تواجهكم في المشاريع؟	السؤال الثاني
Notes and comments		ملاحظات
Question 3	What kind of software development methodology do you use? and why did you choose this approach? ماهي المنهجية التي تتبعونها في تطوير البرامج ؟	السؤال الثالث
Notes and comments		ملاحظات
Question 4	What about the satisfaction of your staff? do you think that they are satisfied with these obstacles ? have you experienced any turnover case recently? ماذا عن موظفيكم هل هم راضون عن جودة العمل ؟ هل حدث ورأيت حالات انسحاب من العمل ؟	السؤال الرابع
Notes and comments		ملاحظات

Thank you for participation

شكرا لك على المساهمة وقبول الدعوة للمشاركة

Interviewer : Mohammed A Bindrees
Heriot Watt University
Mb336@hw.ac.uk
June 2013

Interview Form نموذج مقابلة شخصية

(Layer C) End users

Date and time		التاريخ
Interviewee name		الاسم
Organisation name		اسم المنظمة
Job		الوظيفة
Question 1	What software applications do you use in the workplace? Do need more applications? explain	السؤال الأول
Notes and comments		ملاحظات
Question 2	Do you think IT department in your organisation capable to produce and useful good applications ? Why?	السؤال الثاني
Notes and comments		ملاحظات

Thank you for participation

شكرا لك على المساهمة وقبول الدعوة للمشاركة

vi. Appendix (F)

Audio taped interview transcription

Date	**28-7-2013**
Duration	**15 minutes**
Place	**Ministry Of Education Saudi Arabia**
Interviewees	**Dr H. M.**
Job	**CEO (layer A)**

Interviewer	Thank you sir for giving me this opportunity
Respondent	You are welcome and I hope to provide you with a useful information
Interviewer	There are many software projects in this ministry, to What extent do you think software development projects are challenging and very important?
Respondent	Yes we have three main projects for different purposes. ERP, School management, and training projects Software projects shouldn't be challenging as long as we employ the qualified people. However, if they had any problem they can come to us to solve it.
Interviewer	Do you know what they are doing now?
Respondent	Unfortunately not all the details, but we have regular progress meetings , and IT people present their progression.
Interviewer	How projects are managed in your organisation?
Respondent	As any other projects, we assign a project manager then he work at the IT department until he finishes the project
Interviewer	Who is the owner and the controller of the project?
Respondent	Usually the functional department, who asked for that project to be developed, is responsible about its requirements and clarifications, then IT department take the role in developing the application.
Interviewer	What if they had any conflict?
Respondent	Its unlikely to happen , but if this true I will solve this problem directly
Interviewer	Have you compared your organisation with any other organisations in terms of the e-services
Respondent	No need to compare, there is an E-government project and authority who monitor this issue, and they send us a reports about our progress.
Interviewer	Are you satisfied about you position among other organisations?

Respondent	Well, not quite a lot, We are doing our best and monitoring our projects by ourselves, and I think we have a good position in the near future.
Interviewer	How do you support the IT department?
Respondent	Honestly, they are receiving the highest salaries in this organisation, even the work environment has been designed different from other departments as we believe that they need specific atmosphere.
Interviewer	Thank you indeed for you participation in my research
Respondent	You are welcome

vii. References

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